M A N U A L

Simrad AP20

Autopilot

SIMRAD
A KONGSBERG Company

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Instruction Manual

This manual is intended as a reference guide for operating and correctly installing the AP20 autopilot.

Great care has been paid to simplify operation and set-up of the Simrad AP20, however, an autopilot is a complex electronic system. It is affected by sea conditions, speed of the vessel, hull shape and size.

Please take time to read this manual to get a thorough understanding of the operation and system components and their relationship to a complete AP20 autopilot system.

Other documentation material that is included in this manual is a warranty card. This must be filled out by the authorized dealer that performed the installation and mailed in to activate the warranty.

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Document history

Rev. – First edition

Rev. A Modified system drawings, Figure 1-1 and 4-1. Drawings for junction unit terminal boards included. Page 18: Amendment to operational sequence of R3000X. Description of AP300PX connection included. Modified Installation menu, figure 4-28. NMEA sentence specifications included. Quick reference guide included.

Rev. B Course adjustment selectable between 1° and 10° per push with software version V1R2 (page 19, 27, 32, 33 and 114). New structure for mounting accessories, page 118. Minor correction of display screens on page 24, 25 and 88. FU35 Follow-up Steering Lever included on page 12. New distributor list.

Rev. C AP21 included on drawing page 55. Removed AP300P.
AP21 Connection on page 67 included. LFI3000 substituted by LFI3000 Mk2.

Rev. D Modified note on page 117.

Rev. E New art. no. on Robnet connectors, page 120. New gasket added on page 64 and under Standard mounting kit, page 118. Minor modifications in text.

Rev. F IS11 instruments replaced by IS15. Added RPU300, 24V to the table on page 58. CD100A included. Minor corrections to text and display pictures.

Rev. G Updated according to software versions AP20 V1R3 and J300X V1R8.

Rev. H Added note on page 70. Fig. 4-17 and 4-18 modified.

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1 INTRODUCTION

1.1 General

Congratulations on the purchase of your new Simrad AP20 autopilot system and thank you for selecting what we feel is the most advanced autopilot system available on the market today.

Today, Simrad manufactures a complete range of autopilots for all types of vessels, from leisure boats to advanced steering systems for merchant marine vessels. Our factory for these products Simrad Egersund AS, is located in Egersund on the southwest coast of Norway. The company's involvement in autopilots began in 1953 with equipment for the North Sea fishing fleet under the brand name Robertson. Professional mariners around the world acknowledge that the Robertson and Simrad brand names are synonymous with the absolute best in autopilot technology.

The Simrad AP20 autopilot represents yet another step forward in autopilot technology with the intent of providing leisure boats between 30 and 80 foot with a host of new features. The system can be expanded and enhanced with a selection of options and accessories.

The brain in the AP20 autopilot system is the single "intelligent" junction unit that communicates with all other system modules on the ROBNET network. The ROBNET has been developed to establish a reliable digital communication and power distribution network between the units in the system. The ROBNET simplifies installation and enables the AP20 system to be easily expanded at any time.

1.2 How to use this manual

This manual is intended as a reference guide for operating, installing and maintaining the Simrad AP20 autopilot. Great care has been paid to simplify operation and set-up of the AP20, however, an autopilot is a complex electronic system. It is affected by sea conditions, speed of the vessel, hull shape and size.

Please take time to read this manual to get a thorough understanding of the operation and system components and their relationship to a complete AP20 autopilot system.

Other documentation material that is provided with your system includes a warranty card. This must be filled out by the authorized dealer that performed the installation and mailed in to activate the warranty.

1.3 System components

A basic AP20 system consists of the following units (refer to Figure 1-1):

- AP20 Control Unit with accessories
- Heading sensor
- Rudder Feedback Unit with transmission link
- Junction Unit
- Drive unit

The basic system can be expanded with remote control unit, hand held remote and steering lever.

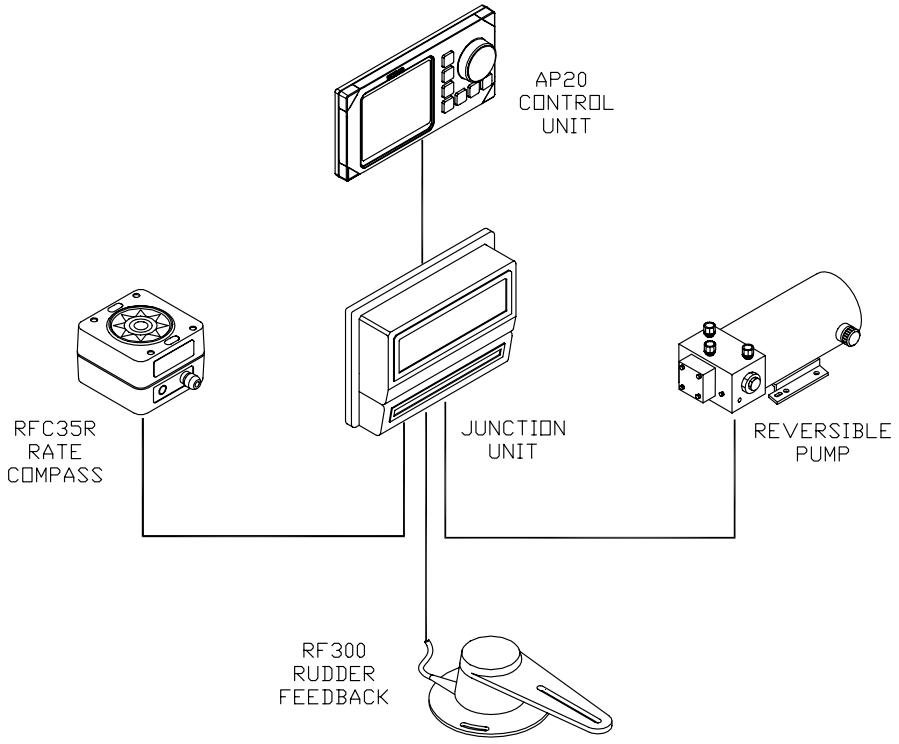


Figure 1-1 AP20 Basic system

1.4 AP20 Control Unit

A compact autopilot control for panel, bulkhead or bracket mounting. Large LCD display for readout of autopilot data and rotary course knob. It has two Robnet connectors for system interconnection and expansion.

1.5 Junction units

The junction unit is the heart in the AP20 autopilot system. It contains the steering computer, interface circuits to all system components and drive circuits for the drive unit motor and clutch. Three models, J300X, J300X-40 and J3000X are available.

Junction unit comparison chart:

	J3000X	J300X (J300X-40)
Supply voltage	10-28 V	10-40 V
Motor current (continuous/peak)	6/10 A	10/20A (20/40A)
Clutch/bypass current	1,5 A	1,5 A
Number of control units	2	5
NMEA ports (input/output)	1	2
Solenoid output	x	x
Input for NFU control	x	x
External alarm		x
Radar clock/data interface		x

1.6 RF300 Rudder Feedback unit

Rudder feedback unit with transmission link and 10 m (30 feet) of cable. Transforms the angular travel of the rudder to a digital signal read by the autopilot steering computer.

1.7 Heading Sensors

The AP20 autopilot can be used with the following combinations of heading sensors:

RFC35 Electronic Fluxgate Compass

A compact heading sensor from Simrad with 15 m (45 feet) of cable. The direction of the earth's magnetic field is sensed by a floating ring core in a fluxgate coil and transformed to a digital signal read by the autopilot steering computer.

RFC35R Rate compass

Fluxgate compass with integrated rate sensor. Provides a dramatic improvement to the dynamic performance of both the autopilot and a stabilized radar display.

Same dimensions as RFC35.

CDI35 Course Detector Interface and CD100A Course Detector

Interface and sensor unit to connect AP20 to a magnetic compass. The AP20 provides excitation current for CD100A and converts the analogue sin/cos signal to digital two wire format for the autopilot steering computer.

Note ! *You can not connect both an RFC35 and a CDI35 at the same time.*

NMEA compass

(Applies for AP20 V1R3/J300X V1R8)

Any NMEA 0183 compass with HDT, HDG or HDM messages can be connected directly to the J300X/J300-40X junction units.

Other fluxgate compass models

The optional CI300X can interface AP20 to fluxgate compasses with heading signal on a sine/cosine format.

Simrad RGC10 and RGC50 gyrocompasses

The optional CI300X unit is needed to interface the two gyrocompass models. No other gyrocompass models can be interfaced to AP20.

1.8 Optional equipment

A series of options are available for the basic AP20 system.

R3000X Remote Control

A small handheld remote control with two push buttons for power steering or course selection (port and starboard), and one push button with built-in lighted indicator for limited mode change.

S35 NFU Lever

S35 is designed for indoor and outdoor bulkhead mount. The lever has spring loaded return to mid-position. A push button with light indicator is used for limited mode change.

FU35 Follow-Up Steering Lever

The FU35 Follow-up steering lever features a dial (scale) with 10° markings. The rudder will move and stop at the commanded angle as read on the dial. FU35 has a mid-position detent, push buttons for (limited) mode selection and mode indicators (STBY, FU, AUTO and NAV). It is designed for indoor and outdoor bulkhead or panel mount. See separate manual for FU35.

NI300X NMEA Interface Unit

Unit with 4 NMEA I/O ports for communication to other systems, and a selectable heading output for radars (Anritsu or Furuno). Includes two Robnet connectors for connection to the AP20 system.

CI300X Compass Interface

Unit for interface to non-Simrad fluxgate compasses and windvane systems with analogue output, and NFU levers. Input for Simrad RGC50 and RGC10 gyro compasses.

2 OPERATION OF THE AUTOPILOT

WARNING ! An autopilot is a very useful navigational aid, but DOES NOT under any circumstance replace a human navigator.

Do not use automatic steering when:

- **In heavy traffic areas or in narrow waters**
- **In poor visibility or extreme sea conditions**
- **When in areas where use of autopilot is prohibited by law**

When using an autopilot:

- **Do not leave the helm unattended**
- **Do not place any magnetic material or equipment near heading sensor used in the autopilot system**
- **Verify at regular intervals course and position of vessel**
- **Always switch to Standby mode and reduce speed in due time to avoid hazardous situations**

2.1 Overview

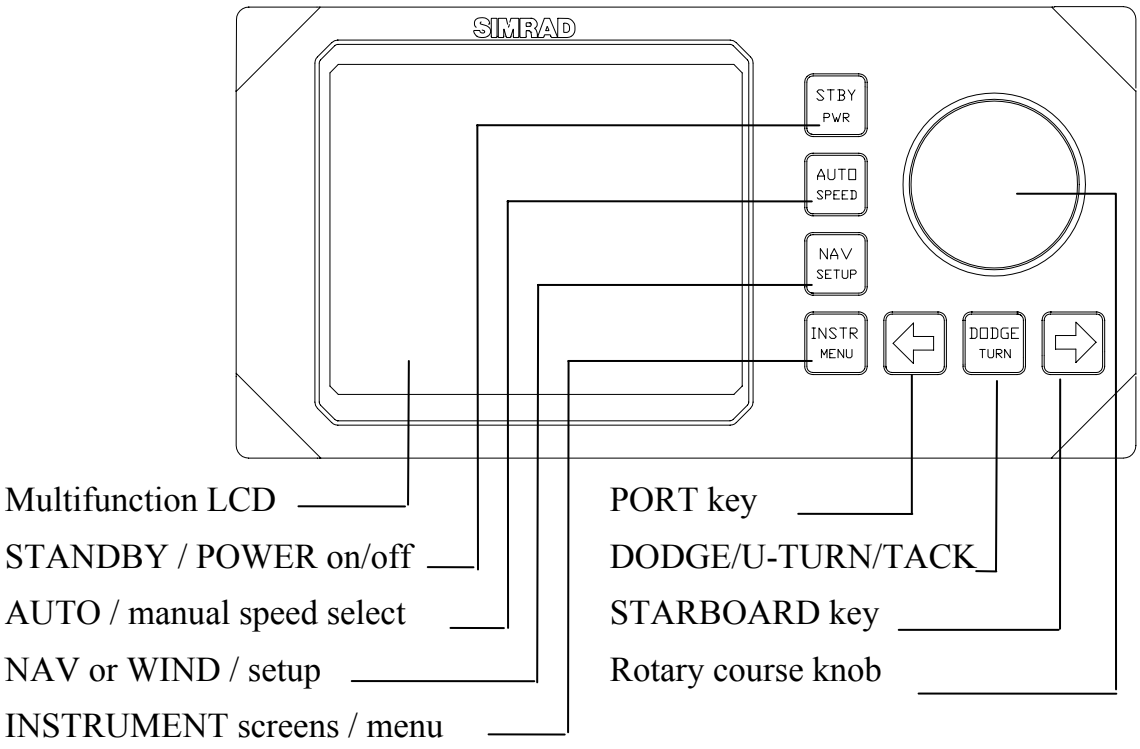


Figure 2-1 AP20 Front Panel

The control unit shown above can operate as a stand alone unit in an autopilot system or combined in a multistation system. In a multistation system the command can easily be transferred from one unit to another. Units not in control will display "Inactive".

The AP20 system is capable of the following primary steering modes: STBY (manual steering), AUTO, NAV and WIND, each mode having a dedicated push button.

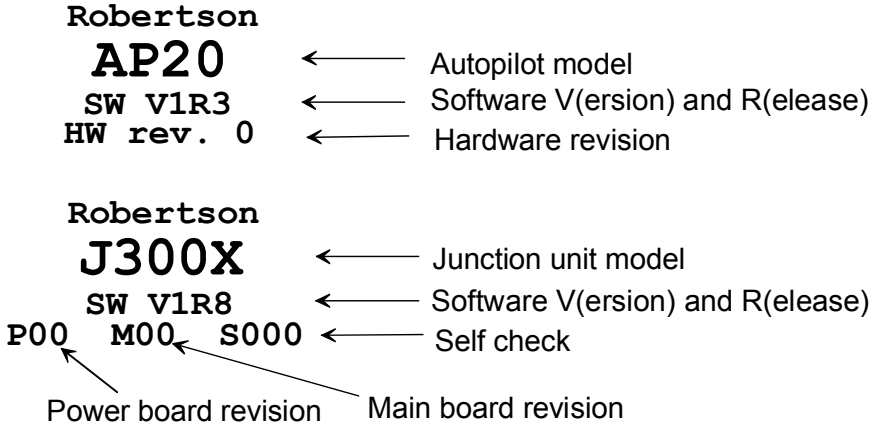
Each of the mode push buttons is clearly identified with the primary function in large text, and a secondary function listed in smaller text. Each button provides you with the ability to access a primary display, a secondary display and/or multiple function displays.

A group of user adjustable settings are provided in the AP20 USER SETUP MENU (page 31). The settings allows adjustment of display visibility, selection of heading sensors, navigation and position sources and the ability to select between automatic or manual adjustable sea state filter.

Alarms are presented in plain text to alert you of system and external data failure conditions. Alarms include both audible and visual presentations. The alarm listing is on page 109.

2.2 ON/OFF - Standby mode

A single press on the STBY button switches the system ON and the following status displays are shown:



SW and HW revisions shown are examples only.

After approx. 5 seconds the system is operative and the unit that was turned on will show the STBY mode display. Other units in a multistation system will display "Inactive". Control can be available at any unit by pressing the STBY button.

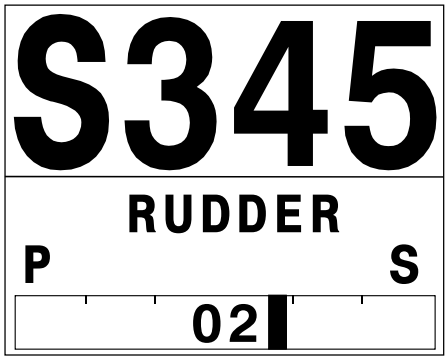
A long press (2-3 sec.) on the STBY button switches the system OFF.

Note ! *In an emergency it is possible on a multistation system to turn OFF the system at any control unit by pressing down the STBY button for 2-3 seconds.*

STBY mode is also the mode that is used when steering the boat at the helm.

Display information:

Standby mode, current heading 345° and rudder angle 2° to starboard.



Flashing course knob icon

When the course knob is used for settings etc., an icon will flash on the screen to tell that no course changes can be made unless you press the AUTO button.

2.3 AP20 with MSD50 Stern Drive unit

Note ! *The information in section 2.3 only applies if your autopilot is driving a Simrad MSD50 Stern Drive.*

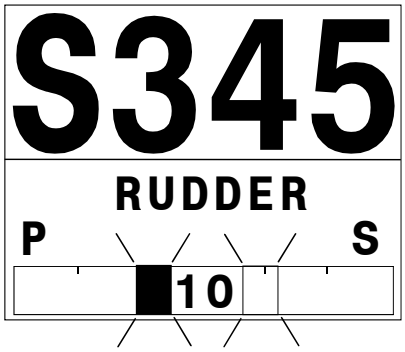
The MSD50 Stern drive unit has a relative feedback signal which needs a zero point setting after the autopilot has been turned on. Refer to page 1-1 of the MSD50 manual for further information.

Zero point setting

Note ! *If you do not need a rudder angle display when leaving the dock, just steer the boat manually on a straight course and press the AUTO button. The zero point is then set auto-matically.*

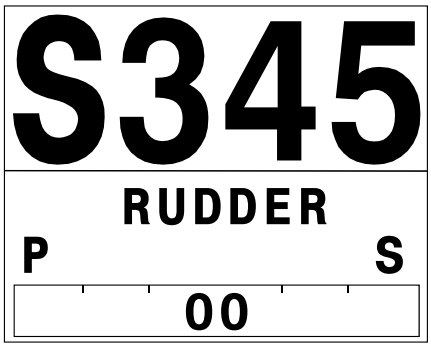
If you prefer to use the rudder angle display when leaving the dock, proceed as follows:

After turn on the rudder angle display will alternate between 10 degrees port and starboard to indicate that the "rudder" zero point need be set.



Use the wheel to bring the "rudder" to midship position. Turn the wheel from lock to lock (H.O. to H.O.) and count the exact number of turns. Then start from one lock position and turn the half number of turns.

Press AUTO and then STBY. The zero point is now set and the display will show:



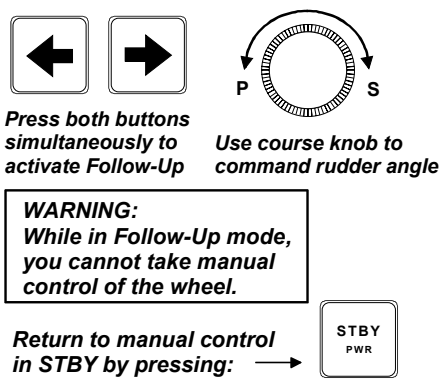
Operation

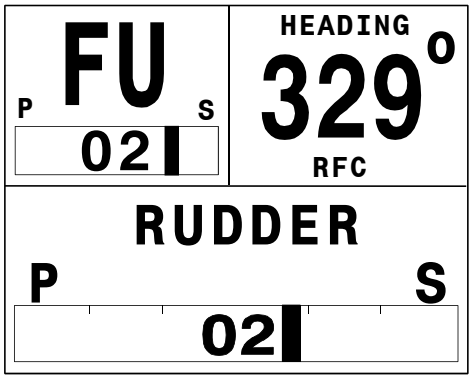
Follow the operating instructions on the following pages. There is no further need for zero point settings until next time you turn the autopilot on.

2.4 Follow-Up steering (FU)

When both the PORT and STBD push buttons are pressed simultaneously the AP20 is set to Follow-Up steering mode and rudder commands can be set by the course knob. One revolution of the knob equals 44° rudder command. The commanded rudder

angle is shown on the display and the rudder will move to the commanded angle and stop.

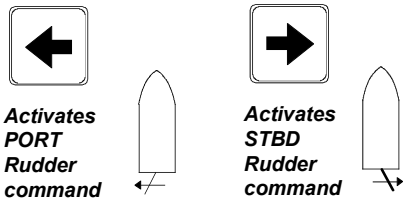

P
S
Press both buttons simultaneously to activate Follow-Up
Use course knob to command rudder angle
WARNING:
While in Follow-Up mode, you cannot take manual control of the wheel.
Return to manual control in STBY by pressing:
STBY
PWR

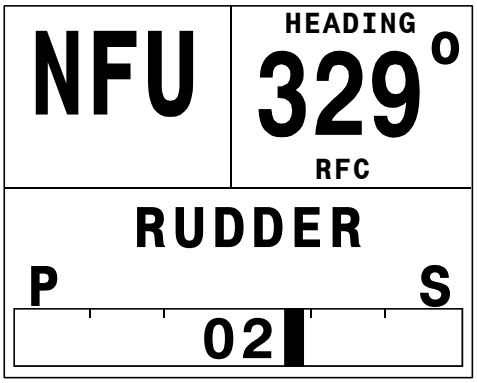


Actual rudder angle

2.5 Non-Follow-Up steering (NFU)

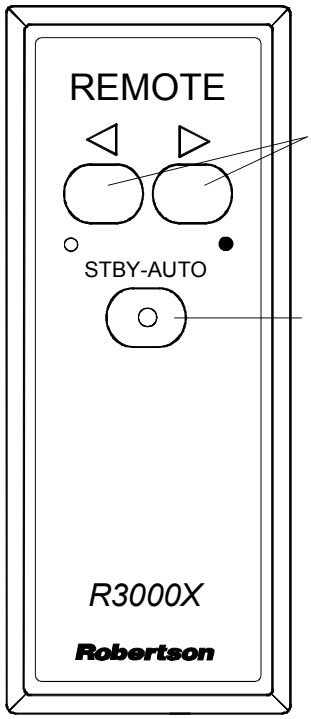
When PORT or STBD push button is pressed in STBY mode the NFU display is presented. The rudder will move as long as the button is pressed and the actual rudder angle is shown on the display.





Actual rudder angle

2.6 R3000X Remote Control



In STBY mode the rudder will move as long as the Port or Stbd button is pressed.

In AUTO mode, the set course will change 1° each press.

Note!
If you keep the button pressed, it will automatically change the course at a rate of 3°/second.

Operation of mode button cycles the pilot as follows:
AUTO → STBY → AUTO
*NAV → STBY → AUTO**

** NAV mode can only be entered from the Control unit.*

2.7 S35 Steering lever

The principle is similar to that of R3000X Remote Control (see above). The rudder will move as long as the lever is offset to Port or Starboard.

Note ! *When a NFU steering lever or remote control is operated, the control unit(s) become "Inactive".*

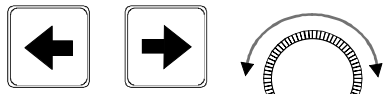
2.8 Automatic Steering

The AUTO mode is used to make the AP20 steer the boat automatically on a set course. AUTO is always available from any mode or function within the AP20 by a single press on the AUTO button. When changing from STBY to AUTO mode, the AP20 uses the current boat heading as the set course and the simultaneous rudder angle. This gives a bumpless transfer at the mode change.

In AUTO, the AP20 is issuing rudder commands to keep the boat on the set course. Heading input is provided by the compass for course keeping in AUTO mode.

The AP20 will keep the boat on the set course until a new mode is selected or a new course is set with either the course knob or the PORT or STBD buttons. One revolution of the course knob equals 44° course change.

Once the course is changed to a new set course, the boat will automatically turn to the new heading and continue to steer the new set course.



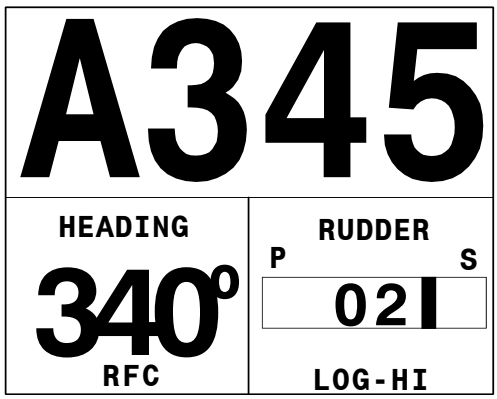
Decrease ***Increase***

Course adjust 1°(or 10°)/push

Course change CW: Increase CCW: Decrease

Set course: 345 degrees
Compass heading: 340 degrees
Rudder angle: 2 degrees to stbd.
Speed input source: LOG
Speed parameter: HI

Regain manual steering by pressing:



Note ! *The 10° course adjust by port or stbd button is available from software version V1R2 onwards (see page 33).*

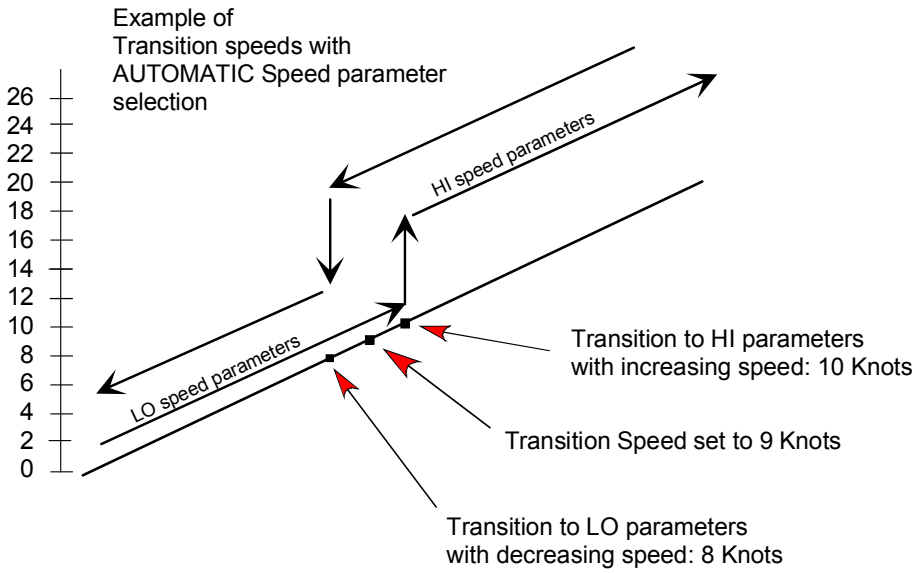
2.9 Automatic Speed selection

The AP20 provides two different sets of steering parameters for controlling the response of the boat at different speeds (HI or LO) while in AUTO and NAV modes.

The AP20 always selects the HI speed steering parameters when first switched on. This is a safety feature. After initial turn on, selection of the steering parameters may be accomplished automatically, based on the availability of input data from either an external speed log or an external navigator, or manually.

The AP20 automatically selects the HI or LO parameter set. The speed at which the AP20 changes from HI to LO (or opposite) is determined by the "Transition Speed" set in the Installation Setup Menu.

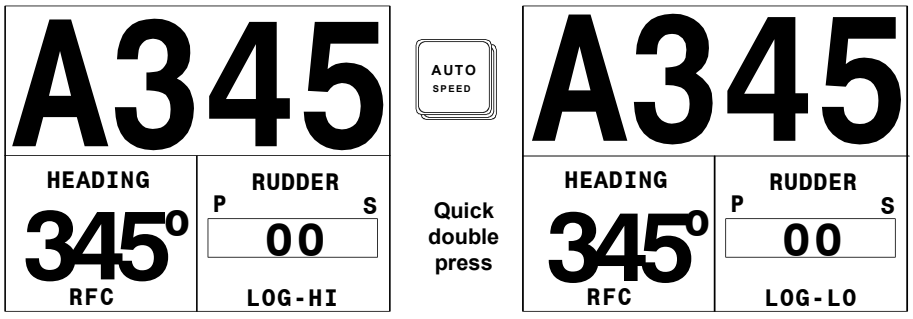
Note ! *It is not recommended to use automatic speed switching if input is from Loran.*



2.10 Manual speed selection

Select AUTO mode. To toggle between HI and LO speed parameters, press the "AUTO" button two times quickly.

If you change boat speed it is recommended that you select HI or LO parameters correspondingly.



Note ! *The manually selected speed setting (HI or LO) will override the automatic speed selection and remain in effect until you re-enter AUTO mode.*

2.11 Navigating with the AP20

The AP20 has the capability to use steering information from an external navigator (GPS, Chart Plotter) to direct the boat to a specific waypoint location, or through a route of waypoints. In the NAV mode, the AP20 uses the heading sensor as it's reference for course keeping. The steering information received from the external navigator alters the set course to direct the AP20 to the destination waypoint.

Note ! *Navigational steering must only be used in open waters. The process of having an external navigation receiver direct an autopilot can be a slow acting process. By selecting the NAV mode, the AP20 is set for automatic steering on the current set course and then waits for the user to accept the course change to the destination waypoint.*

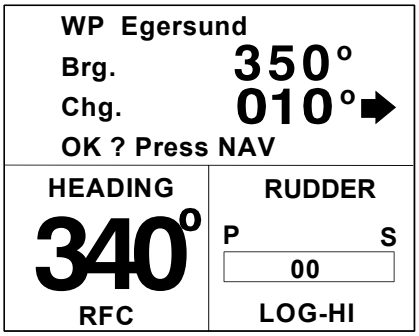
To obtain satisfactory navigation steering, the following points must be fulfilled prior to entering the NAV mode:

- The AP20 autosteering must be tested and found satisfactory.
- The navigation receiver must be operating and the navigation system (GPS, Chart Plotter) must be in full operating mode with adequate signal characteristics for valid position and steering data.
- At least one waypoint must be entered and selected as the current waypoint in the navigation receiver.
- The navigation source in the AP20 USER SETUP menu must be set for the navigator that contains the current waypoint.

The AP20 is designed to steer in “mixed mode” operation. This combines the straight steering capability of cross track error (XTE) steering in conjunction with the turning capability of bearing mode steering (Course To Steer, CTS).

Press

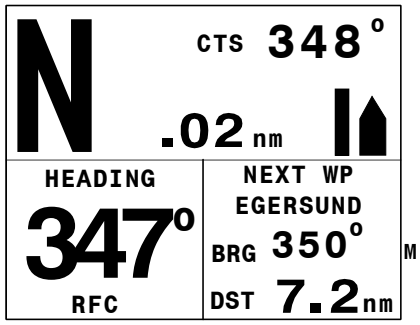
to activate prompt display



Press again to activate NAV mode

Display readout:

Course to steer: 348°
Cross track error: .02 nm to stbd.
Compass heading: 347° M or T
Next waypoint: Egersund
Bearing to waypoint: 350°
Distance to waypoint: 7.2 nm



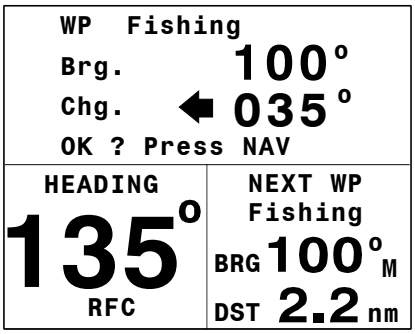
* Course to steer is the course set internally in the autopilot to steer the boat on to the track.

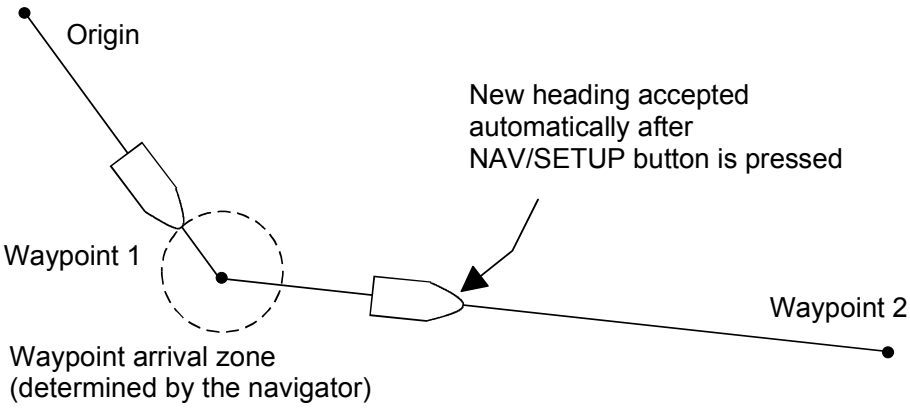
When operating the AP20 in NAV mode to automatically steer through a route of waypoints, the AP20 will steer to the first waypoint in the route after you accept the first waypoint as the location to steer to. When you arrive at the waypoint, the AP20 will give an audible warning and display an alert screen with the proposed new course information displayed. If the required course change is more than 10° you will need to verify that the upcoming course change is acceptable. Verification is performed by pressing the NAV button after the alert screen is displayed. If no verification is received, the AP20 will continue on the current set course in AUTO mode.

At the arrival of each new waypoint in a route:

Verify course change greater than 10° by pressing:

Regain manual steering at any time by pressing:





2.12 Selecting a different Navigator

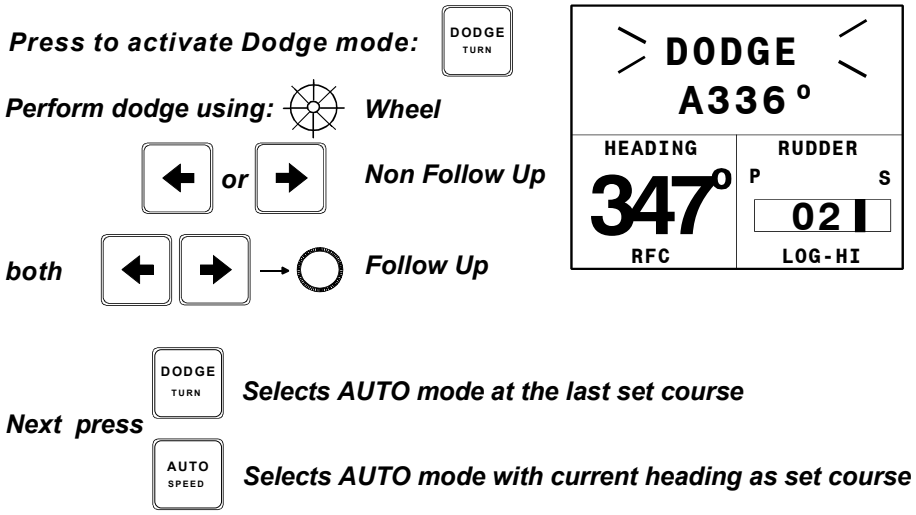
If you have more than one navigation source connected to the AP20, you will be able to choose any for navigation. Refer to the User Set-up menu for details on selecting a different navigator.

Note ! *If the AP20 is connected to a navigation receiver that does not transmit a message with bearing to next waypoint, it will pick a XTE message and steer on Cross Track Error only. In that case you have to revert to AUTO mode at each waypoint and manually change set course to equal bearing to next waypoint and then select NAV mode again.*

2.13 Dodging

Dodging is useful in situations where you need to quickly take control of the helm to steer around an obstruction, and then wish to return to the previous set heading after performing the evasive manoeuvre. Dodging is activated by a quick press on the DODGE button.

When in DODGE mode the displayed set course is the last one set prior to activating the dodge function. When DODGE is displayed, the AP20 is no longer in control of the steering, and you must either manually steer the boat in STBY mode or take control using Non Follow Up or Follow Up steering. On manual steering (STBY mode) the clutch or bypass valve in the drive unit will be disengaged. The AP20 will remain in the DODGE mode until you exit DODGE by a second press on the TURN/DODGE button or select another mode.



Note ! *Using NFU or FU sub modes while dodging will make "NFU" or "FU" flash instead of "DODGE".*

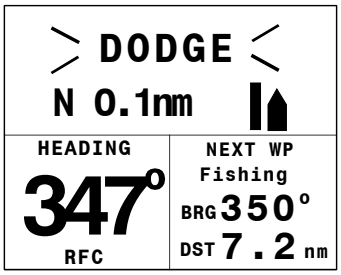
2.14 Dodge in NAV

Press to activate Dodge mode: DODGE TURN

Perform dodge using: *Wheel*

or *Non Follow Up*

both *Follow Up*



To return from Dodge mode press one of the following buttons:

NAV SETUP — ***Selects NAV mode at present position with new bearing to waypoint***

AUTO SPEED — ***Selects AUTO mode with current heading as set course***

DODGE TURN — ***Returns to NAV mode at the current track (not recommended as it may result in a big course change)***

2.15 TURN-mode

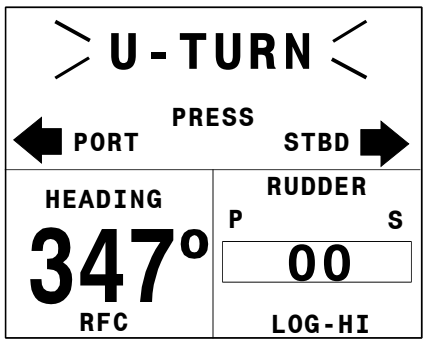
The AP20 provides a special U-turn feature when in AUTO mode. This feature is very useful in a man overboard situation.

U-Turn changes the current set course to be 180 degrees in the opposite direction. The user may decide if the U-Turn should be made to Port or Starboard to bring the boat on the new course. U-Turn is activated by a quick double press on the DODGE button. The AP20 will continue on the set course until you press either the PORT or STBD button to select the direction to make the U-Turn. If you do not press PORT or STBD within 1 minute, the AP20 will return to the AUTO mode and stay on course.

Quick double press to enter TURN mode DODGE TURN

Press to select STBD U-turn

Boat makes STBD U-turn



2.16 Tacking in Auto mode

When the AP20 is installed on a sailboat, a fixed tack of 100 degrees can be made in AUTO mode.

The use of this function should be carefully considered based on the boat's characteristics and the weather conditions. The tack function should only be used into the wind and must be tried out in good weather conditions with light wind to find out how it works on your boat. Due to wide range in boat characteristics (from cruising to racing boats) the performance of the tack function may vary from boat to boat. Except for the course change of 100° and the difference in displays, the procedure is similar to that of the U-Turn described on page 25.

2.17 Wind vane steering

Prior to entering WIND mode the AP20 system should be operating in AUTO, with valid input from the selected wind transducer. The WIND mode is an alternative function to the NAV mode and it is only available if the system has been set up for SAIL-boat in the Installation Menu, and NAV/WIND source is set to WIND under the USER SETUP menu. (Refer to page 31).

WIND function can only operate when reaching as it is necessary to have a stable apparent wind. The sails should be trimmed so that the autopilot easily can steer the boat in AUTO mode and the wind transducer must give a stable signal.

Enter the WIND mode by pressing the NAV/SETUP button.

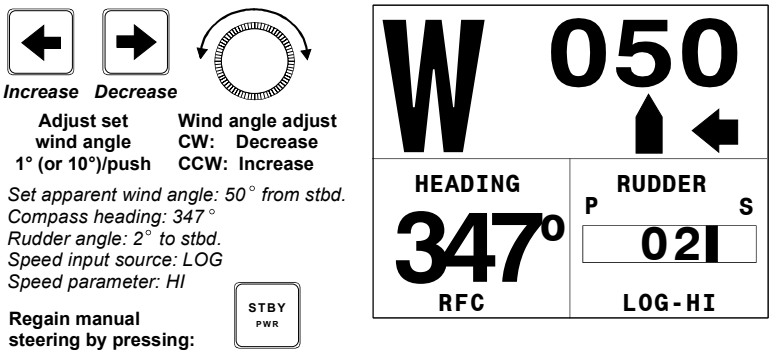
The pilot will read the apparent wind angle at the moment the WIND function is selected and enter it as the set apparent wind angle. From that point the pilot will change the course to maintain this apparent wind angle as the wind direction may change.

Note ! *If the cumulative shift of the apparent wind exceeds 15° from the value at the time the WIND mode was selected, a WIND SHIFT alarm will sound.*

The display will show the set apparent wind angle. Adjustments to this set angle can be done by using PORT or STBD button or the rotary course knob.

The display is also presenting current heading and rudder angle.

Dodging while in the WIND mode is very similar to dodging while in the AUTO or NAV modes. Refer to DODGE mode operation in the AUTO mode section on page 24.



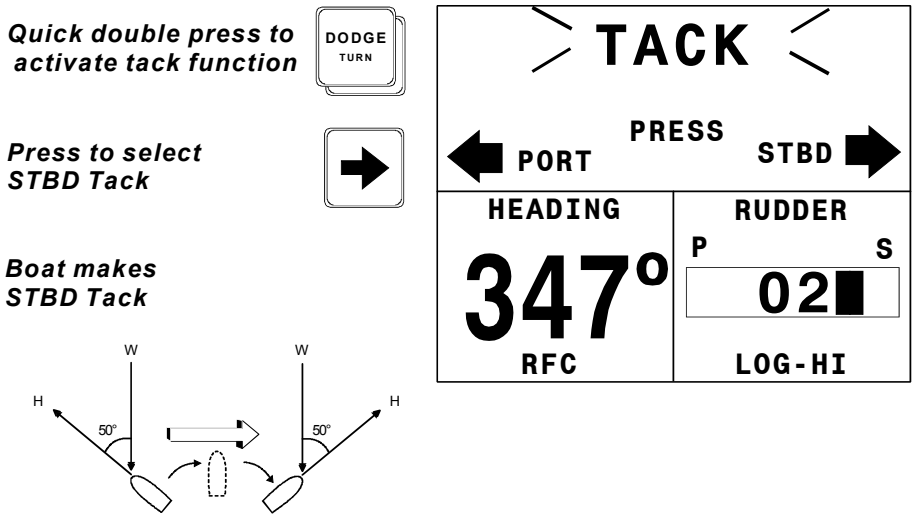
Note ! *The 10°/step wind angle adjust by port or stbd button is available from software version V1R2 onwards (See page 33).*

2.18 Tacking in Wind mode

In WIND mode on sailboats there is also a tacking aid function. This function may only be used when the boat is reaching and will when activated take the boat from the course you are steering to the computed course that gives you the same apparent wind on the other side.

This tacking function as compared to tacking in AUTO mode can only be used when you are sailing with the apparent wind as the reference (WIND mode), and with apparent wind angle less than 80-90 deg.

A quick double press on DODGE will activate the tack function which will prompt you for which way the tack should be performed. Press PORT or STBD to select the tack.



2.19 Multiple station system

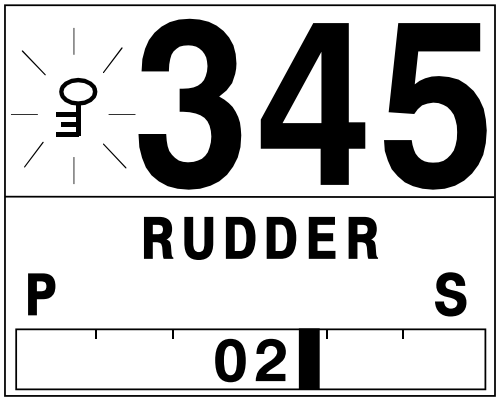
In normal operation of multiple control units, control is accessible from every control unit connected to the AP20 system. One control unit is "active" and provides the user with access to all functions and enables the user to change modes and set the course for automatic course keeping. All remaining control units are "inactive" and have no effect on mode changes or course selection. A single press on any of the mode buttons on an "inactive" control unit will allow transfer of command and make it "active".

2.20 Lock function

The "LOCK" function is a safety feature included in the AP20 system when you have more than one control unit installed. It will disable all control units except for a single, user selected control unit location.

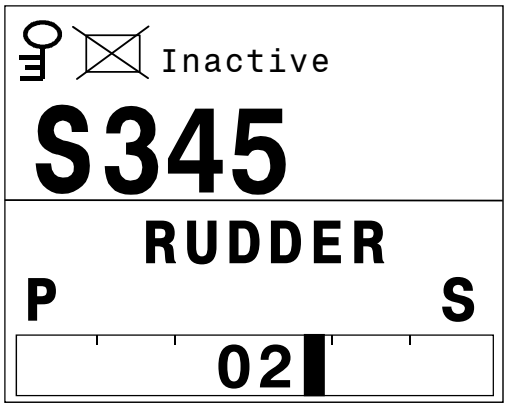
When the "lock" function is in use, no transfer of command may take place; only the "active" control unit stays in command.

To enable the "lock" function, make a quick double press on the STBY button.



The display on the "active" control unit will first show a icon and then the icon will alternate with the mode index.

The "locked" control units in the system will show:

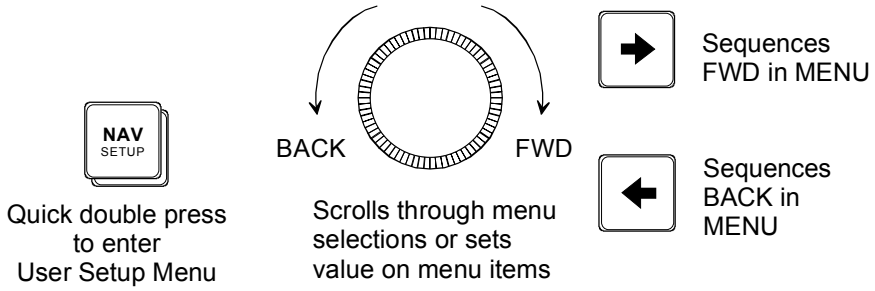


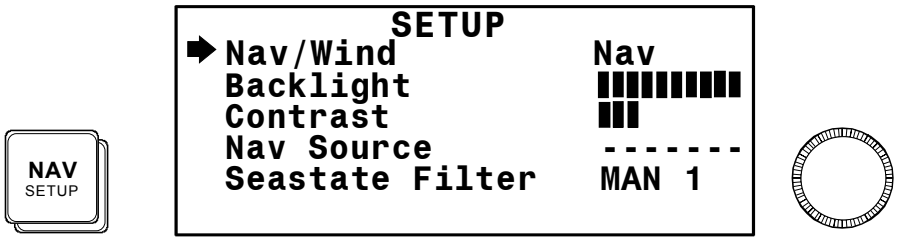
The “Lock function is disengaged by the following actions:

- The “active” control unit unlocks by another double press on the STBY button.
- The system is switched OFF by any control unit (press STBY for 2-3 seconds).

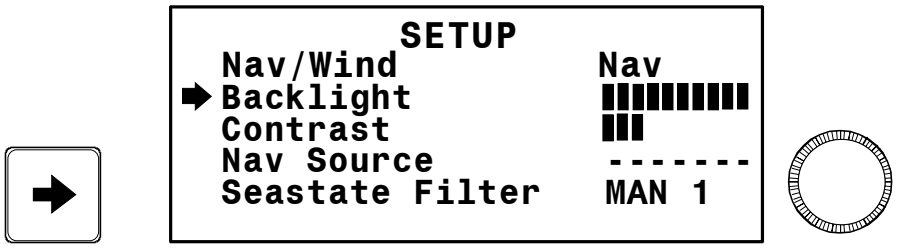
After having "unlocked" the other control stations, the "active" control unit will show the above symbol before the display returns to normal. All other control units will return to the "inactive" state.

2.21 User Set-up Menu

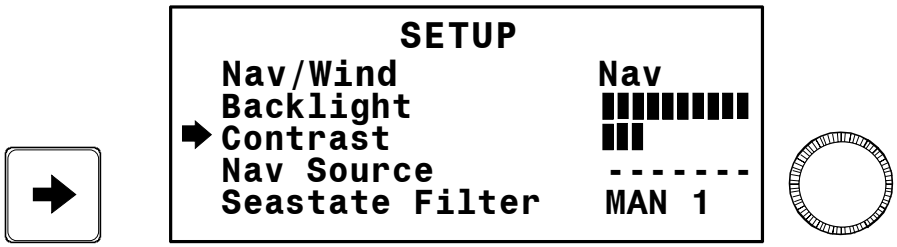




The Nav/Wind selection only appears if the autopilot is configured for sailboat. (See Dockside settings, page 85). Selects whether NAV mode button will activate NAVigation mode or WIND mode steering.

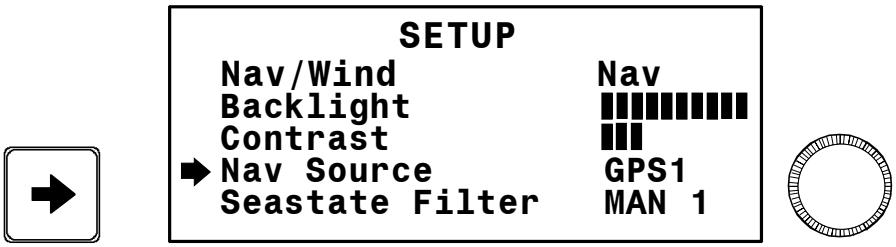


Adjust backlight of display and pushbuttons (10 steps, 10 = brightest). Setting is stored when system is turned off, and resets to stored level at turn on. Adjustment is local to the control head you adjust.

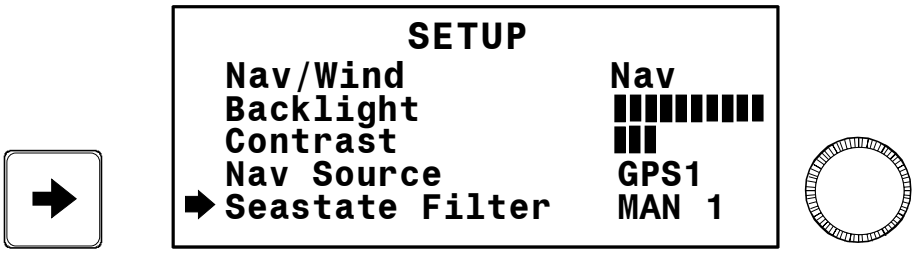


Adjust contrast of displays (10 steps). Setting is stored when system is turned off, and resets to stored level at turn on.

Adjustment is local. All steps are not available at high temperatures due to automatic temperature compensation.



Select the source for NAV mode steering. Refer to interface setup table on page 94.

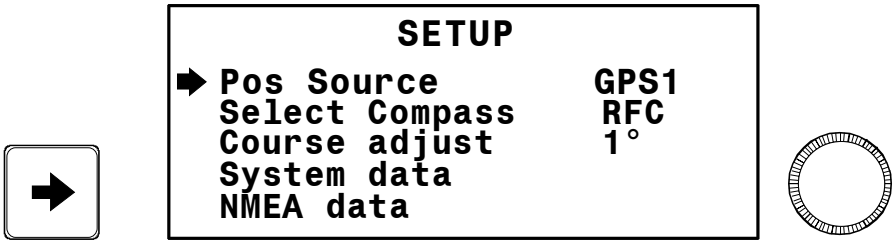


Select value for Sea State Filter.

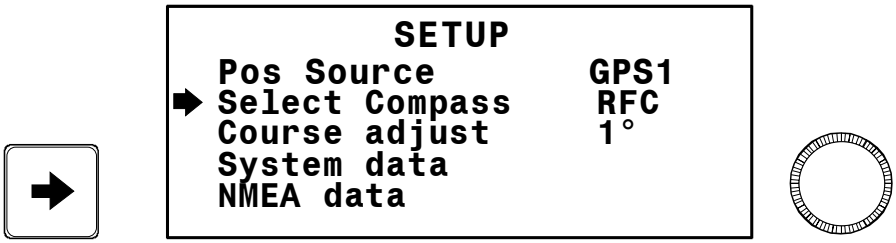
OFF: Provides precise steering but increases rudder activity.

AUTO: Reduces rudder activity and reduces sensitivity of autopilot in rough weather automatically.

MANUAL: Sets yaw band manually (1-10, 10 ≈ ±6°).



Select the source of speed over ground (SOG) and position data processed by AP20. This option will only appear if there is more than one navigation receiver connected to the system.



Select the compass to be used for AUTO steering, if more than one compass is connected. Refer to the interface setup table on page 93.

RFC = Simrad RFC35 Fluxgate compass or Simrad RFC35R Rate compass (See Note)

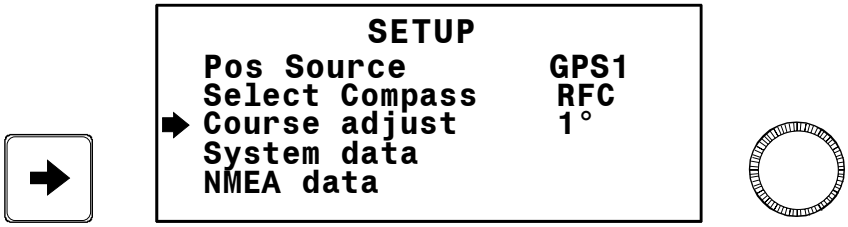
MAGN = Magnetic compass (or Simrad RFC35 Fluxgate Compass. (See Note)

FLUXG = Non-Simrad fluxgate compass

GYRO = Simrad gyrocompass

NMEA = NMEA compass (Applies for AP20 V1R3/ J300X V1R8 onwards)

Note ! *It is necessary to select the correct compass and Nav. source to make the autopilot operate. If a Simrad RFC35 Fluxgate compass is used as backup to the RFC35R, it is selected when MAGN is displayed.*



When using the PORT or STBD buttons in automatic mode you are changing the set course in 1° increments. If you prefer the increments to be 10° each press, proceed as per below:

Select *Course adjust* using the PORT or STBD button. Turn the rotary knob to display the setting. The default value is 1° which is the preferred setting. Select 10° if you want to make major course changes in 10° steps with the buttons and fine tune the set course with the rotary knob.

Note ! *The course adjust menu item is available from software version V1R2 onwards.*

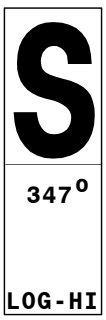
System data and NMEA data are test functions to analyse data processed by the AP20. (See Trouble shooting page 109).

Except when NMEA data or System data is displayed, the menu will disappear after 30 seconds if no key is pressed. It will disappear immediately if any mode key (STBY, AUTO or NAV/WIND) is pressed.

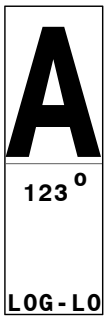
2.22 Instrument screens and menu

A number of instrument screens are available under each mode screen if the required NMEA 0183 sentences are provided (see paragraph 3.1). The instrument screen is activated by a single press on the INSTR button.

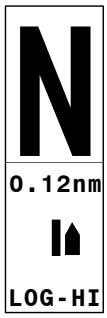
Left hand side of the screen will show the following information depending on mode:



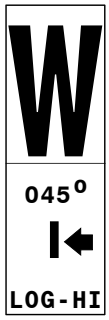
Standby.
Heading.
Speed input source.
HI speed parameters.



Auto.
Set course.
Speed input source.
LO speed parameters.

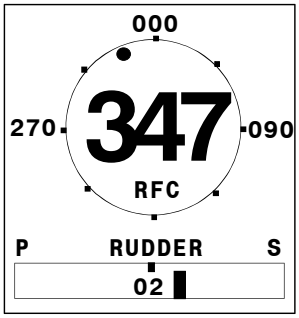


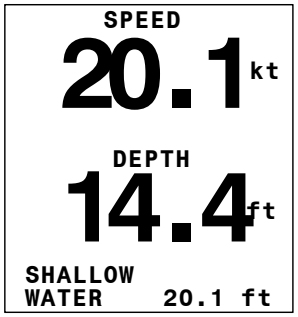
Nav.
Cross Track error.
Speed input source.
HI speed parameters.

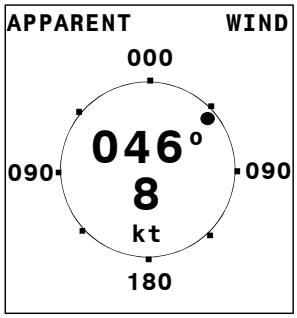


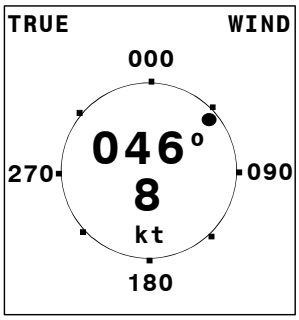
Wind.
Set apparent wind angle.
Speed input source.
HI speed parameters.

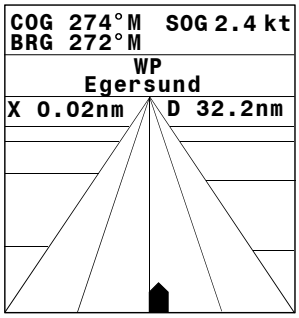
Step through the available instrument screens by repeatedly pressing the INSTR button. The right hand side of the display will show the following instrument screens:

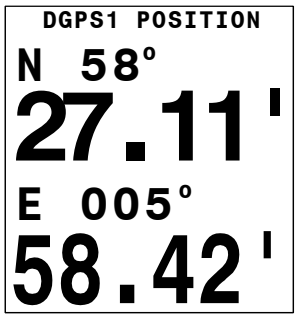


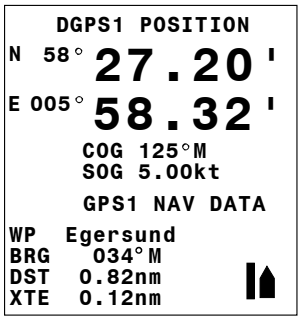


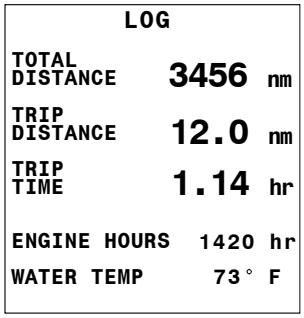




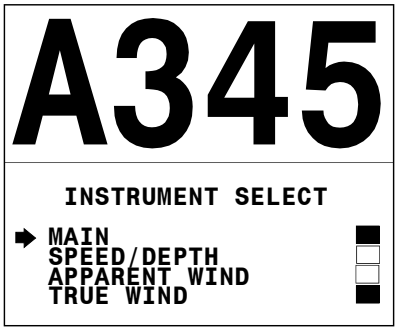


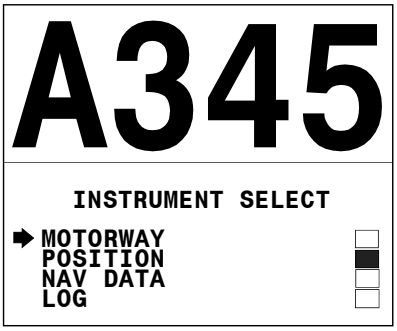






If you do not need all the instrument screens to be present in the screen menu, you may remove screens by making a quick double press on the INSTR button. Step through screens by pressing the STBD/PORT buttons. Each screen can be removed or selected by rotating the course knob.

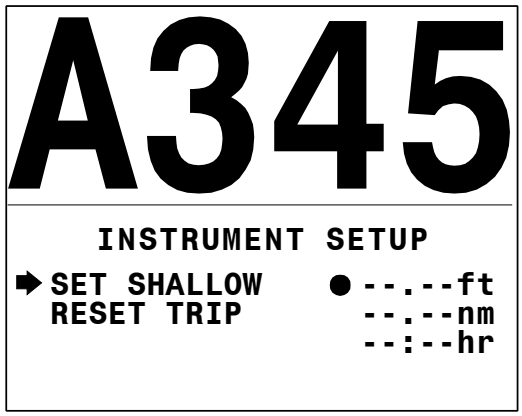




Return to last instrument screen by a simple press on the INSTR button.

Instrument set-up

This screen gives access to the set-up of the Shallow Water Alarm and the Trip reset. Press and hold the INSTRUMENT button to activate the screen as shown.



Select item using the STBD [>] button and the course knob to set the shallow water alarm limit. Also use the course knob to reset the trip counter.

Note ! *The shallow water alarm is activated only when digits are dialled in.*

The setting of the alarm is local. In a multistation system, however, the setting representing the deepest water limit will activate the alarm even if this setting is on an "inactive" unit.

Flashing course knob icon

When the course knob is used for settings etc., an icon will flash on the screen to tell that no course changes can be made unless you press the AUTO button.

3 TECHNICAL SPECIFICATIONS

3.1 AP20 Autopilot System

Boat size and type:..... Up to 80 feet, Power, Displacement, Sail

Steering system types: ..... Hydraulic, Mechanical

Inter-unit connection: ..... ROBNET network or two-wire supply/data

System ON/OFF: ..... From control units

Supply voltage: ..... See junction units

Power consumption: ..... Dependent on system configuration

Environmental Protection:

- Control Unit: ..... IP56 from front, IP43 from back.
- RFC35, RFC35R, CDI35: IP56
- RF300: IP56
- J300X: IP44
- NI300X, CI300X: IP44

EMC protection: ..... EN60945 : 1993, A1 : 1993

Automatic Steering control:

- Rudder Drive: ..... Proportional rate or solenoid on/off
- Parameter selection: ..... Automatic with manual override
- Sea state control: ..... Adaptive sea state filter or manual

Language selection: ..... English, Norwegian, French, Spanish, German, Italian, Dutch, Swedish.

Electronic Interface:

- Navigation interface:..... Standard (NMEA 0183)
- NMEA inp./outp. ports: .... Max. 6 (see junction units and NI300X specifications)
- NMEA input sentences: .... APA, APB, BOD, BWC, BWR, BWW, DBK, DBT, DPT, GGA, GLL, MTW, MWV, RMA, RMB, RMC, VHW, VLW, VTG, VWR, XTE, XTR, ZTG, ZDA, (PSTOE, PSTOI).
- NMA output sentences: .... BWC, BWW, GLL, HDG, HDM, HDT, HSC, RMB, RMC, RSA, VTG, XTE.
- Optional output: ..... Anritsu and Furuno radar display (clock/data)

Heading sensors:

Standard: ..... RFC35 Electronic Fluxgate compass

Options:..... Magnetic compass
RFC35R Rate compass
NMEA Compass (Not J3000X)
Simrad RGC50/RGC10 gyrocompasses *
Analogue fluxgate compass (sin/cos)*
Analogue wind vane (sin/cos)*
* By CI300X

Course Selection:..... Rotary course dial and push button

Alarms: ..... Audible and visual, optional external

Alarm modes: ..... Off course, system failures, overload

Steering modes: ..... Standby, Non-follow up, Follow-up, Auto, Nav, Wind

Special Turn modes:..... Dodging, Tacking, U-Turn

Instrument screen interface:

Instrument screen	**NMEA messages**
MAIN (HDG+RUDDER)	ROBNET™ PROPRIETARY
SPEED/DEPTH	VHW + DBK/DBT/DPT
APPARENT WIND	MWV/VWR
TRUE WIND	MWV/VWR + VTG/RMC/RMA
MOTORWAY	APB + RMB + VTG + GGA/RMC
POSITION	GGA/RMC/RMA
NAV DATA	APB + VTG/RMC + GGA/RMC + RMB/BWC
LOG	VLW + MTW + PSTOE (Proprietary Robertson IS11 message for engine hours)

Note ! *Alternative messages are separated by slashes.*

3.2 AP20 Control Unit

Dimensions:..... See Figure 3-1

Weight: ..... 0,5 kg (1.1 lbs)

Power consumption ..... 3 W

Display:

Type: ..... Backlit LCD matrix display
Resolution: ..... 160 x 128 pixels

Colour: ..... Black

Illumination: ..... Adjustable in 10 steps

Environmental Protection: ..... IP56 from front, IP43 from back.

Safe distance to compass: ..... 0.5 m (1.6 ft.)

Temperature:

Operating: ..... 0 to +55 °C (+32 to +130 °F)
Storage: ..... –30 to +80 °C (–22 to +176 °F)

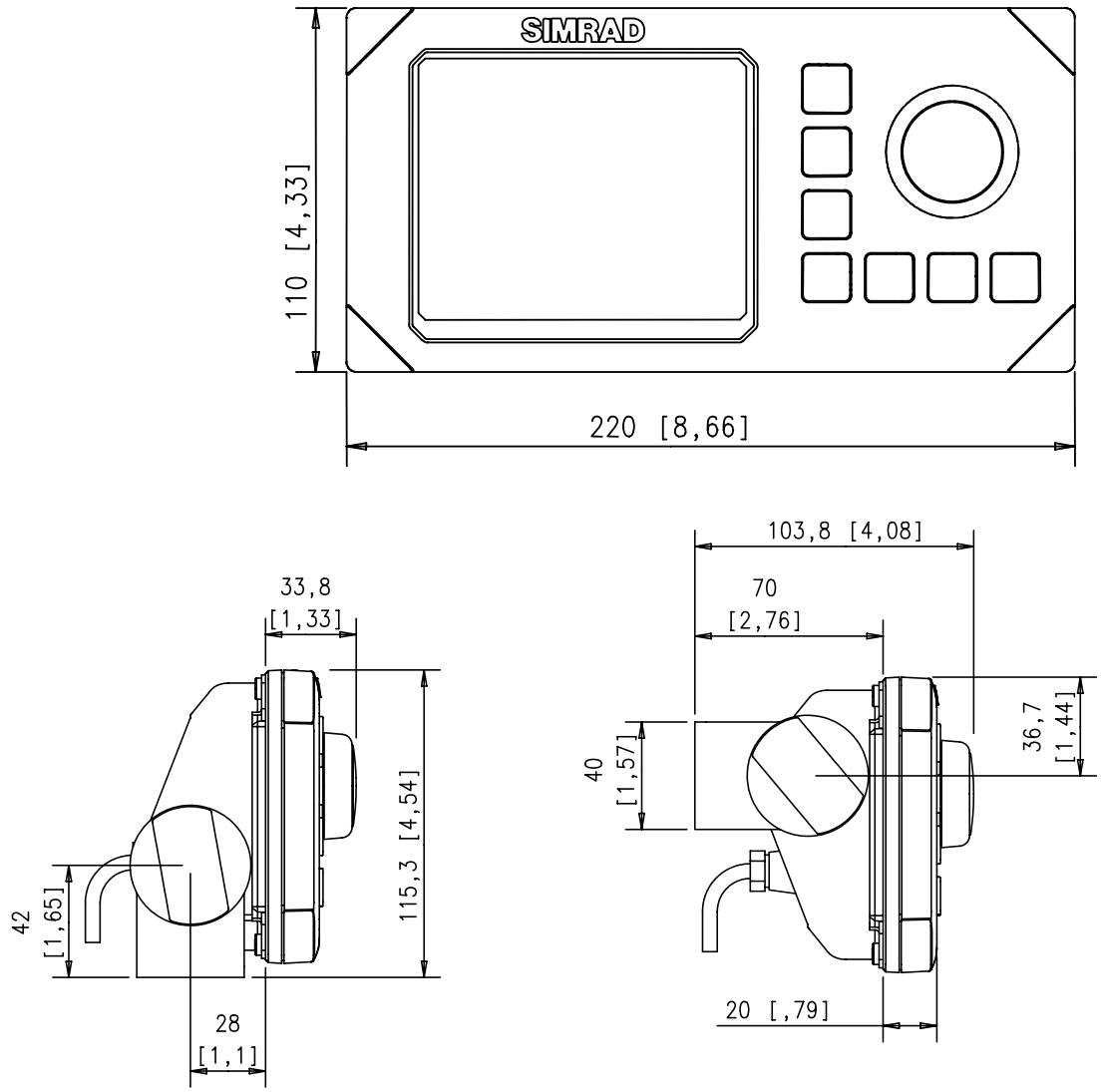


Figure 3-1 AP20 Control Unit – dimensions
(Mounting bracket is optional equipment)

3.3 Junction units

Dimensions: ..... See Figure 3-2 and Figure 3-3

Weight:

- J300X/J3000X ..... 1,3 kg (2,9 lbs.)
- J300X-40..... 2,8 kg (6,2 lbs)

Supply voltage:

- J3000X ..... 10-28V DC
- J300X/J300X-40 ..... 10-40V DC

Reverse voltage protection ..... Yes (not J300X-40)

Power consumption: ..... 5 Watt (electronics)

Motor / solenoid drive:

- J3000X ..... 6 A continuous, 10 A for 5 sec.
- J300X ..... 10 A continuous, 20 A for 5 sec.
- J300X-40..... 20 A continuous, 40 A for 5 sec.

Heading Sensor input: ..... Composite pulse width modulated

Rudder feedback input:..... Frequency signal, 3400 Hz., 20 Hz/deg.

Rudder feedback units: RF300, LF3000

NMEA input/output ports:..... J3000X: 1 (one)
J300X, J300X-40: 2 (two)

External Alarm: ..... Open collector

Temperature range:

- Operation: ..... 0 to +55 °C (+32 to +130 °F)
- Storage: ..... –30 to +80 °C (–22 to +176 °F)

Mounting: ..... Bulkhead mount

Material:..... Anodized aluminium and black ABS cover

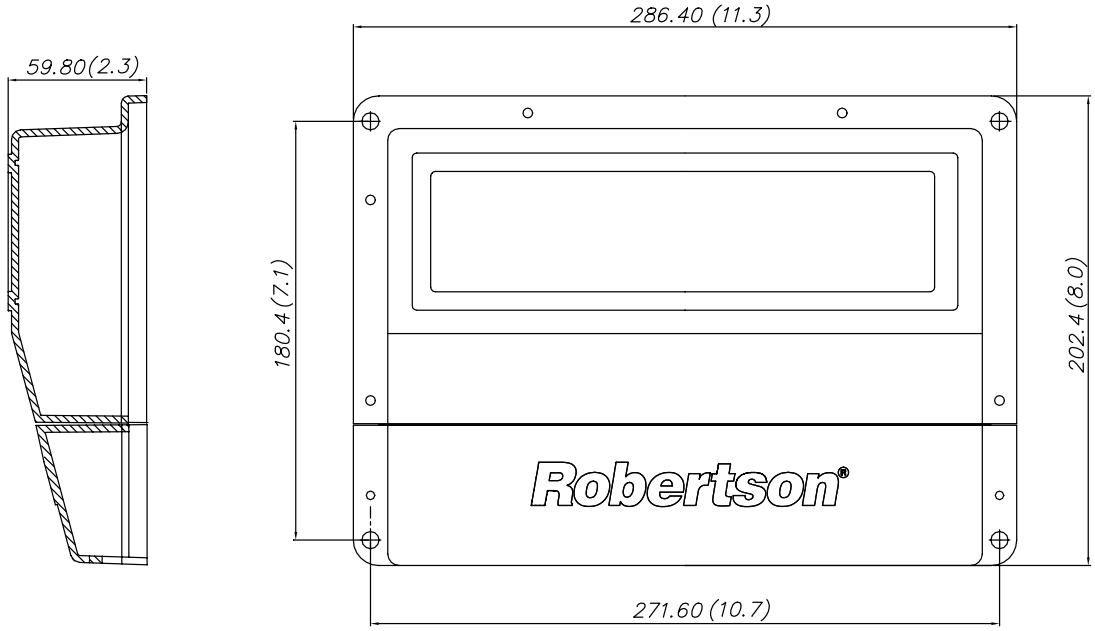


Figure 3-2 J300X/J3000X Junction Unit - Dimensions

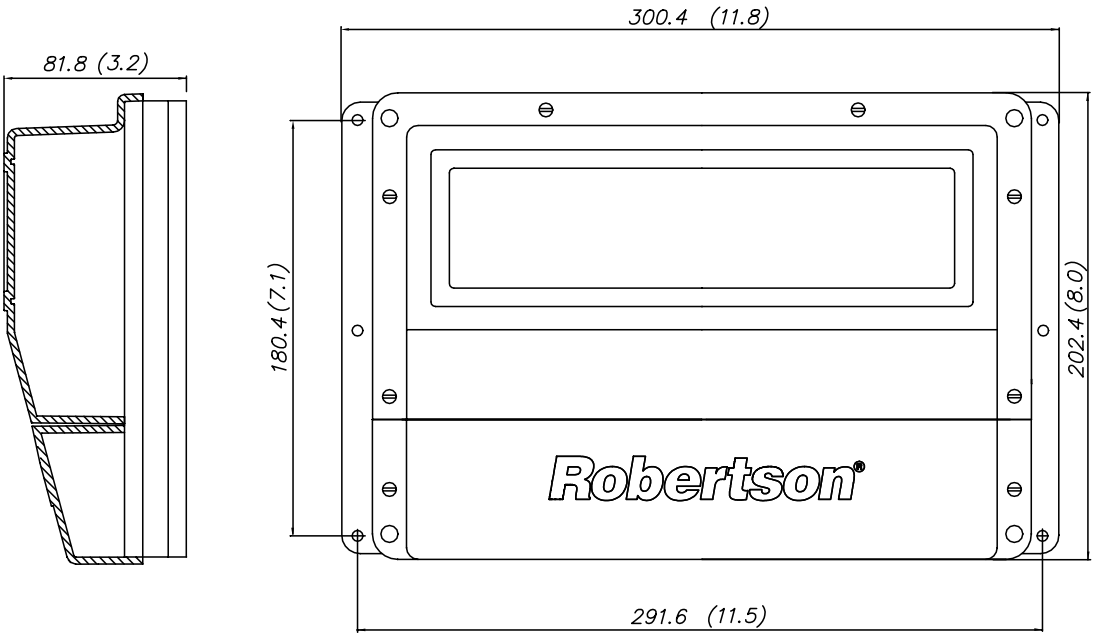


Figure 3-3 J300X-40 Junction Unit - Dimensions

3.4 RFC35 Fluxgate compass

Dimensions: ..... See Figure 3-4

Weight: ..... 0,9 kg (2,0 lbs)

Supply and output: ..... Polarity independent 2-wire supply with superimposed pulse width modulation

Automatic Performance:

- Calibration: ..... Automatically activated by control head
- Gain compensation: ..... Automatically adjusted continuously

Repeatability: ..... ± 0.5 degrees

Roll/Pitch: ..... ± 35 degrees

Accuracy: ..... ± 3 degrees after calibration

Cable supplied: ..... 15 m TP shielded cable

Temperature range:

- Operation: ..... 0 to +55 °C (+32 to + 130 °F)
- Storage: ..... –30 to +80 °C (–22 to +176 °F)

Environmental Protection: IP56

Mounting: ..... Deck or bulkhead

Material: ..... Black ABS

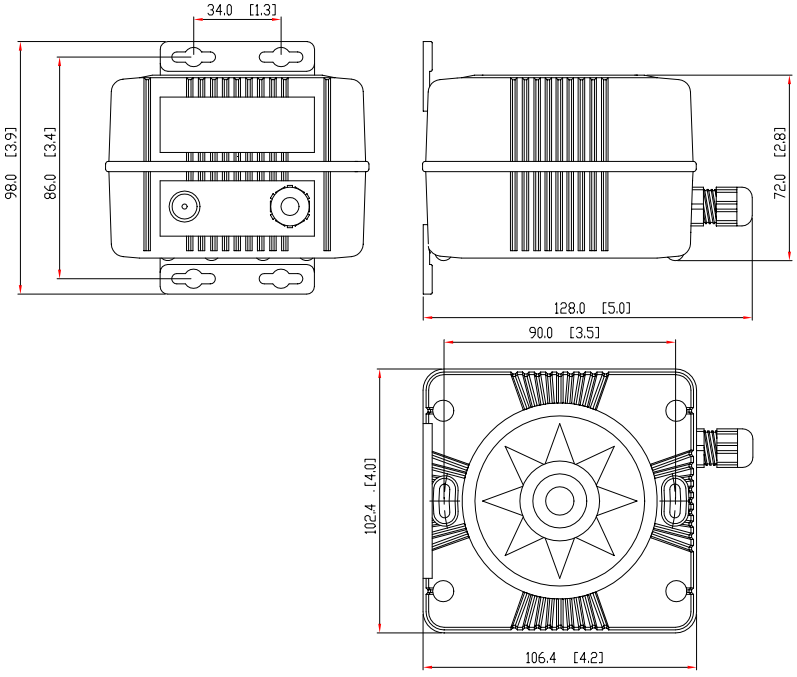


Figure 3-4 RFC35 Fluxgate Compass - Dimensions

3.5 RFC35R Rate compass

Dimensions: ..... See Figure 3-4

Weight: ..... 0,9 kg (2,0 lbs)

Supply and interface: ..... Robnet

Power consumption: ..... 0,9 watts

Automatic Performance:

- Calibration: ..... Automatically activated by control head ....
- Gain compensation: ..... Automatically adjusted continuously
- Rate sensor stabilized heading output

Accuracy: ..... <1.25° (rms)

Repeatability: ..... <0.2° (rms)

Roll/Pitch: ..... ± 35 degrees

Cable supplied: ..... 15 m TP shielded cable

Temperature range:

- Operation: ..... 0 to +55 °C (+32 to + 130 °F)
- Storage: ..... –30 to +80 °C (–22 to +176 °F)

Environmental Protection: IP56

Mounting: ..... Deck or bulkhead

Material: ..... Black ABS

3.6 CDI35 Course Detector Interface

Dimensions: ..... See Figure 3-5

Weight: ..... 0,9 kg (2,0 lbs)

Supply and output: ..... Polarity independent 2-wire supply with superimposed pulse width modulation

Automatic Performance:

- Calibration: ..... Automatically activated by control head
- Gain compensation: ..... Automatically adjusted continuously

Repeatability: ..... ± 0.5 degrees

Accuracy: ..... ± 0,5° (not including errors from course detector)

Cable supplied: ..... 15 m TP shielded cable

Dimensions: ..... 160 mm x 126 mm (6.3 in x 5 in.)

Weight: ..... 0,9 kg including cable (2,0 lbs.)

Power consumption: ..... 0,9 watts

Temperature range:

Operation: ..... 0 to +55 °C (+32 to + 130 °F)

Storage: ..... –30 to +80 °C (–22 to +176 °F)

Environmental Protection: IP56

Mounting: ..... Deck or bulkhead

Material: ..... Black ABS

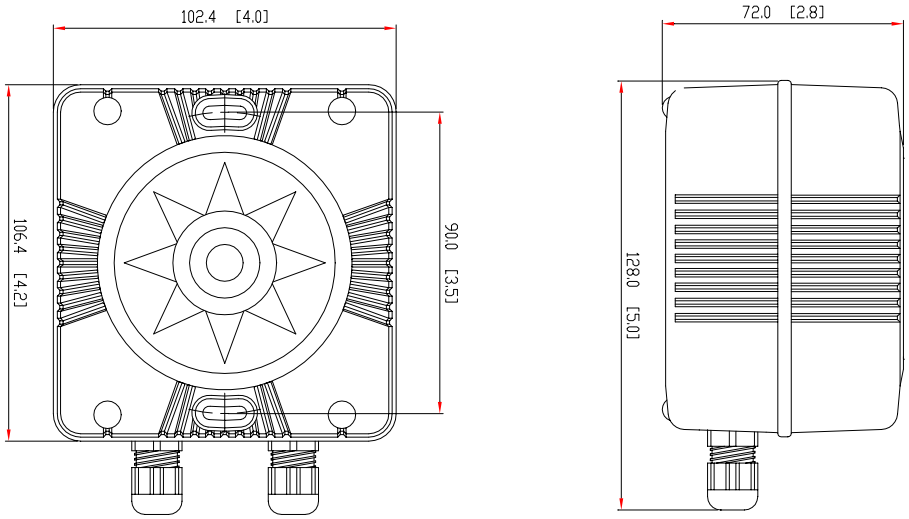


Figure 3-5 CDI35 Course Detector Interface - Dimensions

3.7 RF300 Rudder Feedback

Dimensions: ..... See Figure 3-6 and Figure 3-7.

Weight: ..... 0,5 kg (1,1 lbs)

Rudder angle: ..... ± 90 degrees

Output signal: ..... Polarity independent frequency signal

Frequency resolution: ..... Centre: 3400 Hz, 20 Hz/degree of change

Linearity: ..... ± 3 degrees up to 45 degrees of rudder

Cable supplied: ..... 10 m twisted pair shielded cable

Mounting: ..... Horizontal, vertical, upside down

Material: ..... Polyacetal (POM)

Environmental Protection: IP56

Temperature range:

Operation: ..... –10 to +55 °C (+14 to +130 °F)

Storage: ..... –30 to +80 °C (–22 to + 176 °F)

Transmission link: ..... Stainless 350mm (13.8") with 2 ball joints. Ball joint stud for rudder arm requires 4.2mm dia hole and 5mm tap.

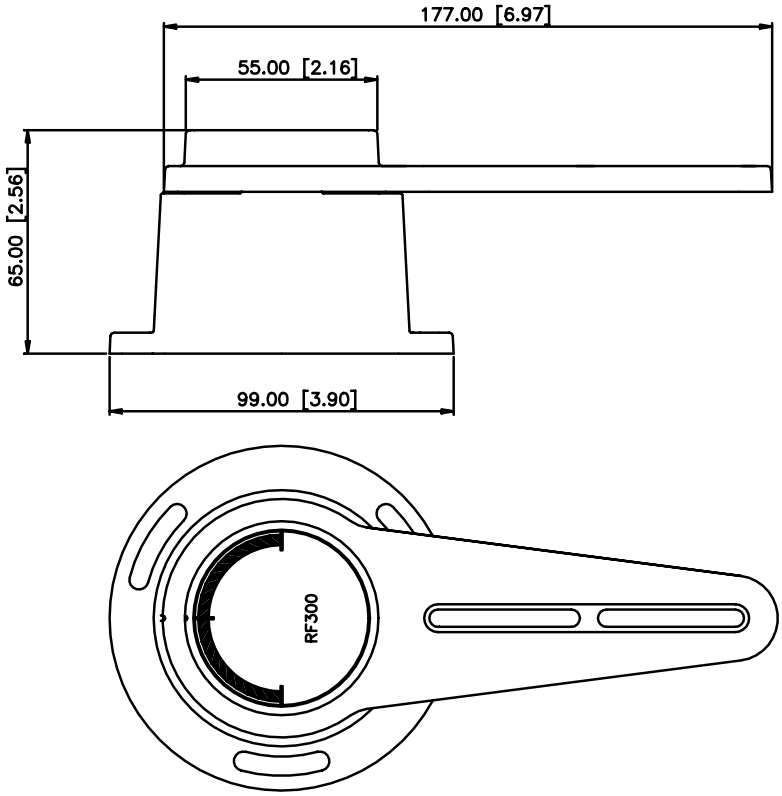


Figure 3-6 RF300 Rudder Feedback - Dimensions

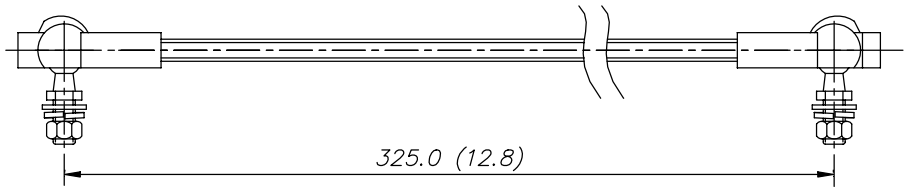


Figure 3-7 Transmission link - Dimensions

3.8 CI300X Compass Interface

Dimensions: ..... See Figure 3-8

Weight: ..... 0,9 kg (2,0 lbs)

Power consumption: ..... 2 W

Gyro compass input: ..... Synchro 1:1 (RGC10/RGC50 gyrocompasses)
Heading or windvane input: ..... Sin/cos max 12V DC
NFU steering lever input: ..... Port/stbd potential free contact
Robnet network interface: ..... 2 network connectors
Cable inlets: ..... Rubber glands for cable diam. 10-14 mm
Mounting: ..... Bulkhead mount
Material: ..... Epoxy coated aluminium
Environmental Protection: IP44
Temperature range:
Operation: ..... 0 to +55 °C (+32 to +130 °F)
Storage: ..... –30 to +80 °C (–22 to +176 °F)

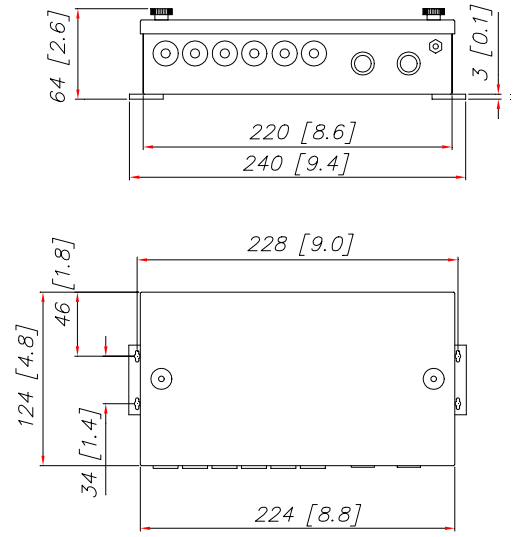


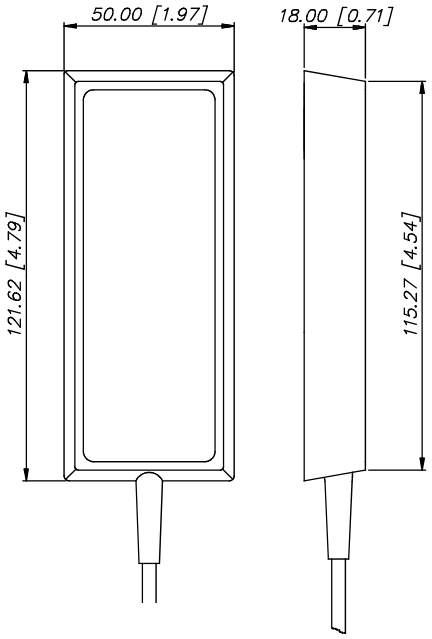
Figure 3-8 CI300X and NI300X - Dimensions

3.9 NI300X NMEA Interface

Dimensions: ..... See Figure 3-8
Weight: ..... 0,9 kg (2,0 lbs)
Power consumption: ..... 3 W
NMEA183 input/output: ..... 4 ports, max output load 20 mA
Heading output: ..... Anritsu and Furuno radar display (clock/data)
NMEA instrument supply: ..... 12V DC, max 0.25A
Robnet network interface: ..... 2 network connectors
Cable inlets: ..... Rubber glands for cable diam 10-14 mm
Mounting: ..... Bulkhead mount

Material:..... Epoxy coated aluminium
Environmental Protection:..... IP44
Temperature range:
Operation: ..... 0 to +55 °C (+32 to +130 °F)
Storage: ..... –30 to +80 °C (–22 to +176 °F)

3.10 R3000X Remote Control



Dimensions: ..... See Figure 3-9
Weight:..... 0,4 kg (0,9 lbs)
Protection IP56
Cable length: ..... 7 m, shielded
Material: .....Epoxy coated aluminium

Figure 3-9 R3000X - Dimensions

3.11 S35 NFU Steering Lever

Dimensions: ..... See Figure 3-10
Weight: ..... 1,4 kg (3,1 lbs) incl. 10 m cable
Protection..... IP56
Power consumption: .... 6 mA
Max. inductive load:..... 4A/12-24VDC 60mA/110VAC, 25mA/220VAC

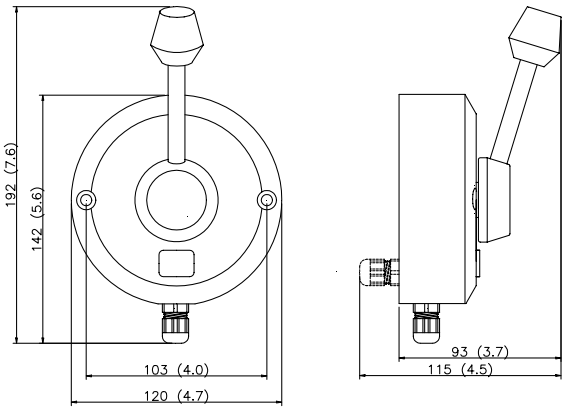


Figure 3-10 S35 - Dimensions

3.12 NMEA messages

NMEA messages and data overview for IS15, AP11, AP20, AP35, AP300X, AP3000(X) and J3xx V1R8

Message ident.		**HDG**	(HDM)	**HDT**	**RSA**	MWV	(VWR)	(DBK)	DBT	**DPT**	MTW	VHW	VLW	GGA	GLL	RMA	RMC	VTG	ZDA	(APA)	APB	BOD
Data source: (n/p/h=nav/pos/heading source, c=calculated):		h	h	h	c									p	p	p	p	p		n	n	n
Accept. cond. (N=no nav. flg warning, P= no pos. flg warning):														P	P	P	P	P		N	N	N
	Status flag													P*	P	P	P			N	N	
Compass_Data	Compass heading, M	2	1									X										
	Compass heading, T	2		3																		
Rudder_Data	Rudder angle				1																	
Wind_Data	Apparent wind angle					2	**1**															
	Apparent wind speed					2	**1**															
Depth_Data	Depth ref transducer							**1**	**3**	**2**												
	Transducer-Keel Offset									X*												
	Depth range									X												
Speed_Temp_Data	Speed through water											**1**										
	Log distance and trip												**1**									
	Water temperature										**1**											
Gps_Data	Present position Lat, Long													**4**	**1**	**2**	**3**					
	COG, T															**1**	**2**	**3**				
	COG, M																	**1**				
	Universal Time Coordinated (UTC)													**3**	1		**2**		4			
	Magnetic variation	x														4	**5**					
	SOG															**1**	**2**	**3**				
Nav_Data	To-wp position																					
	To-wp ident.																			**6**	**7**	**5**
	From-wp ident.																					3
	Bearing wp-wp, T																				6	5
	Bearing wp-wp, M																			5	6	4
	Bearing pos-wp, T																				**4**	
	Bearing pos-wp, M																				**3**	
	Distance pos-wp																					
	Time to go to dest. Wp																					
	XTE																			**4**	**5**	
	Waypoint closure velocity, VMG																					
Steering_contr1	Heading steering cmd, T / M																					
Light_Cmd	IS11 illumination																					
IS15 RX:		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
IS15 TX:		x			x	x				x	x	x	x			x	x				x	
J3xx RX:		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
J3xx TX:	Transmission interval in sec.->	1	1	1	1										2		2	2				
J3xx TX:	If Instr. port (ref instr setup)->	.2	1	.2	.2																	
J3xx V1R7 onwards Channel2 TX:		.1*	1	.1*	1																	

Note ! *1. APB message may read in true or magnetic bearing wp-wp and bearing pos-wp. These fields are sent as magnetic bearings from IS15.*

2. IS15. Magnetic variation from the HDG message is only used to calculate true heading from the data in the same Hdg message, and is not read in to the system.

BWW	BWC	BWR	RMB	WCV	XTE	XTR	ZTG	HSC	PSTOI	PSTOC	PSTOE	PSTOK	Indata use AP11, AP3000(X)	AP35, AP300X	AP20	AP300DLX	Out J3XX	Remarks: Bold red = {IS15, J3xx and IS11Multi} M=Multi only, black = {J3xx and IS15}. Blue 'X' IS15 only. Shadowed not to be used any more
n N	n N	n N	n P P		n P P	n	n	c										N/P=nav/pos data warning, *DGPS if flag=2
														c c			x	
																	x	
													d,c	d,c*	d,c d	d,c d,c		*Not for AP35
															d	d		* Output only
														c c	d d d	d d d		
		M	M				M								d	d,c d d d,c d,c	x x x x	HDG message in to IS15 see note2
		2	1	3										c	d	d	x	
																d,c*	x	Not in/out IS15
1		3	2	4									d*	d	d	d	x	*Not for AP3000
1				2													x	
4														d	d	d	x	IS15 sends bearing as magnetic
3													d	d	d	d	x	
		2	**1**	3										d	d	d	x	IS15 sends bearing as magnetic
		2	**1**										d*	d	d	d	x	* Not for AP3000, wp-wp used if no pos-wp data
		2	**1**	**3**									d*	d	d	d	x	* Not for AP3000
							1									d		
				2		**3**	1						d,c	d,c	d,c	d,c	x	
				X	1													
								1									x	
x	x	x	x x		x	x	x x	x x		x		x x						
x 10	x 10	x	x 2		x 5	x	x	10	x		x		d = displayed c= used in calc.					* HDG out if magn. sensor, HDT out if true sensor

Proprietary sentences in/out IS15:

- In to IS15 $PSTOK,a<CR><LF> Status of compass calibration: a = I:init, R:running, F:failed, C:calibrated.
- Out from IS15: $PSTOK,,,x.x,*XX<CR><LF> Set compass offset. x.x is offset angle, 0 to 360 degrees.
- Out from IS15: $PSTOC,*77<CR><LF> Sent start calibration of compass.

3.13 IP protection

Each part of a Simrad autopilot system has a two digits IP protection code.

The IP rating is a method to classify the degree of protection against solid objects, water ingress and impact afforded by electrical equipment and enclosures. The system is recognised in most European countries and is set out in a number of British and European standards.

The first code number describes the protection against solid objects, and the second number describes the protection against liquids.

FIRST NUMBER Protection against solid objects		**SECOND NUMBER** Protection against liquids	
IP	**TESTS**	**IP**	**TESTS**
0	No protection	0	No protection
1	Protection against solid objects up to 50 mm, eg. accidental touch by hands.	1	Protected against vertically falling drops of water (eg. condensation).
2	Protection against solid objects up to 12 mm, eg. fingers.	2	Protected against direct sprays of water up to 15° from the vertical.
3	Protection against solid objects over 2.5 mm (tools + wires)	3	Protected against sprays to 60° from the vertical.
4	Protection against solid objects over 1 mm (tools + wires + small wires)	4	Protected against water sprayed from any direction.
5	Protection against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets of water from all directions - limited ingress permitted.
6	Totally protected against dust	6	Protected against strong jets of water, eg. for use on shipdecks - limited ingress permitted.
		7	Protected against the effects of immersion between 15 cm and 1 m.
		8	Protected against long periods of immersion under pressure.

4 INSTALLATION

4.1 General

This section provides detailed information required to successfully installing AP20 Autopilot system.

The AP20 system includes several modules that need to be mounted in different locations on the boat, and also need to interface with at least three different systems on the boat:

- The boat's steering system
- The boats electrical system (input power)
- Other equipment on board (NMEA interfacing)

In addition, the advanced capabilities of the AP20 require the installer to perform a series of settings and tests to verify proper operation of the system, refer to the check list below.

4.2 Installation checklist

1. Determine system configuration you are installing (Page 52)
2. Perform the hardware installation (Page 53)
3. Connect external NMEA devices (inputs and outputs, page 70)
4. Set Language (Page 84)
5. Dockside settings (Page 85)
   a) Boat type selection.
   b) Drive unit selection.
   c) Rudder feedback calibration.
   d) Automatic rudder test.
   e) Transition Speed
6. Interface setup for Junction Unit and NI300X/CI300X if installed (Page 90)
7. Perform settings in User Setup Menu page 31, for NAV source, POS source and Compass source
8. Dockside Autopilot tests (refer to Operating Instructions, page 13)
   a) Test all stations (if applicable) - lock/unlock - active/ inactive
   b) Test Non-Follow Up mode
   c) Test Follow-Up mode
   d) Test AUTO mode

e) Test NAV mode and input interfaces (if connected) including optional heading sensors
f) Test interface outputs to external equipment (if connected)

9. Seatrial settings (Page 96)
   a) Set rudder zero
   b) Compass calibration
   c) Compass Offset adjustment
   d) Automatic tuning (Optional: does not need to be done)
   e) Viewing parameters
10. Testing Autopilot Operation at Sea (refer to Sea Trial instructions, pages 96, 104)
11. Provide the user with training (Page 105)

4.3 Unpacking and handling

Care should be taken when unpacking and handling the equipment. A visual inspection should be made to see that the equipment has not been damaged during shipment and that all components and parts are present according to the packing list.

A standard AP20 autopilot system will include:

- Control unit with standard installation accessories.
- Junction unit (J300X, J300X-40, J3000X) and one 15 m (49') Robnet cable.
- RFC35 Fluxgate Compass with 15 m (49') cable attached.
- RF300 Feedback unit with 10 m (33') cable attached and transmission rod.
- Appropriate drive unit for the installation (unless the AP20 is going to operate an existing drive unit or solenoids).
- Optional equipment that may have been ordered for the installation.

4.4 Determine system configuration

It is important to become familiar with the configuration of the system prior to beginning the installation. The AP20 system layout with options is shown in Figure 4-1

Pay particular attention to the junction unit/drive unit combinations on page 58 and the chart on page 10.

As many of the units are communicating on a common network (ROBNET), with identical connectors, the installation is simplified. Try to mount the units within the standard cable length supplied with each unit, if possible. ROBNET Extension Cable (10m) is available from your distributor.

4.5 AP20 System Layout

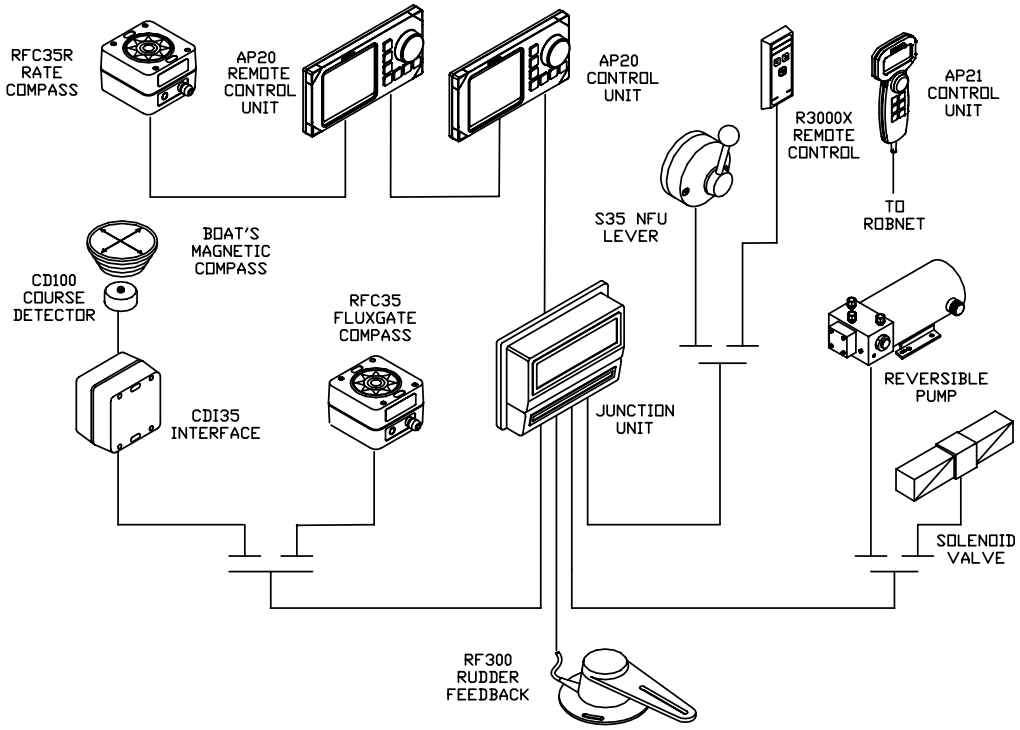


Figure 4-1 AP20 system layout with options

4.6 RF300 Rudder feedback installation

The RF300 Rudder feedback unit mounts close to the rudder, and is mechanically linked to the rudder tiller arm or rudder quadrant.

Refer to Figure 4-2 for the recommended mounting arrangement. Note that the RF300 transmitter arm has two slots for the transmission link. The slots enable maximum flexibility to provide the 1:1 mechanical linkage relationship.

Note ! *Do not try to remove the transmitter arm from the feedback unit. The unit is factory adjusted and need no further adjustment at installation than described below.*

As a starting point, it is desirable to set the transmitter rod to the inner limit of the outer slot if possible. (Refer to Figure 4-2). Drill and tap the rudder tiller arm so that the Y1 dimension is equal to the Y2 dimension (Use 4.2 mm drill and 5 mm tap). Attach the ball joint to the tiller arm, and connect the transmitter rod to the ball joint at the rudder tiller arm.

Turn the helm wheel to set the rudder tiller arm to approximate centre position.

Rotate the RF300 transmitter lever until it is set to centre position. (Use the alignment mark to line up the transmitter lever to be opposite the cable entry into the feedback.).

Note ! *Carefully observe the alignment marks. A rudder feedback alarm may be the result if the alignment instructions as per Figure 4-2 are neglected.*

Attach the transmitter rod to the RF300. Set the RF300 mounting location to be in accordance with Figure 4-2. The centre of the RF300 should be in line with the centre of the rudder post. Mount the RF300 to a suitable platform using the screws provided. If necessary, add blocking material under the RF300 to adjust the height of the transmission arm to be level with the rudder tiller arm.

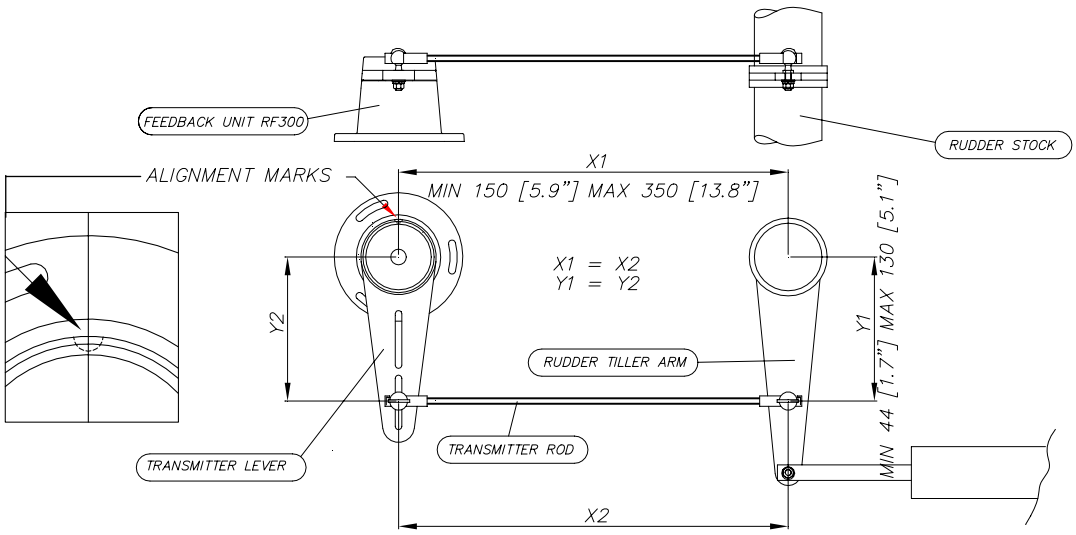


Figure 4-2 RF300 mounting (019356)

Note ! *Due to space limitations, it may be necessary to cut the length of the transmitter rod to move the RF300 closer to the rudder post.*

Tighten the mounting screws for both the RF300 feedback unit and the transmitter rod ball joint.

Observe the RF300 while someone turns the helm wheel through the complete travel from full port to full stbd. rudder to verify that the mechanical linkage to the RF300 is not obstructed.

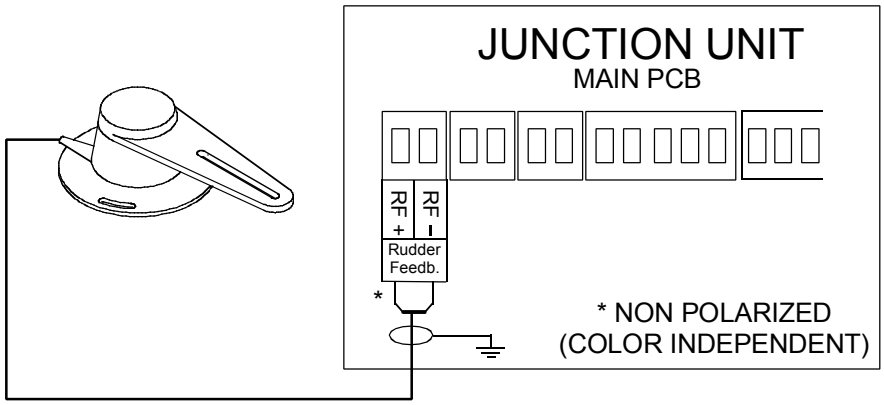


Figure 4-3 RF300 connection

4.7 Junction unit installation

The junction unit is designed to operate in a location that provides ambient temperatures below +55°C (+130°F).

Note ! *The junction units (J3000X, J300X and J300X-40) are not weatherproof and should be mounted vertically as shown in a dry place between the control unit and the drive unit.*

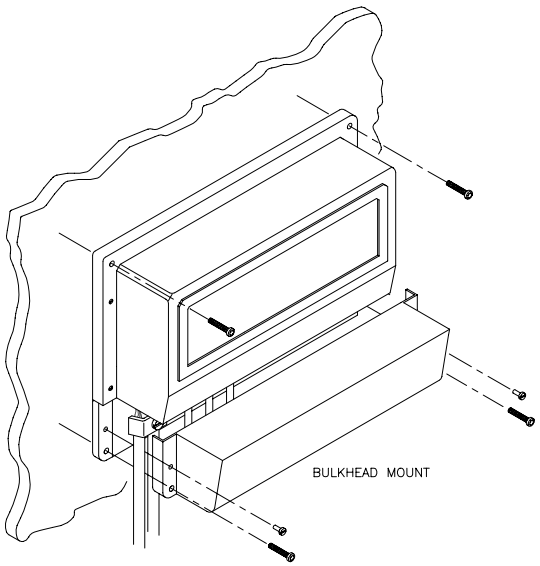


Figure 4-4 J3XX mounting

4.8 Cable connections

Use only shielded cables. This includes Mains input, drive units and if necessary for the extension of the RF300 Rudder Feedback cable. The clutch/bypass cable and the solenoid cable should be 1,5 mm^2 (AWG14). Signal cables should be 0.5 mm^2 (AWG20) twisted pairs.

The mains supply cable and the drive unit motor cable should have sufficient wire gauge. This will minimize voltage drop and allow the drive unit to operate at full power.
Refer to the table below for recommended cable sizes.

Cable length	**Drive Unit Voltage**			
1. Breaker panel to Junction Unit.	12 V		24V	
2. Junction Unit to Drive Unit motor (Length refers to each of the two cables)	AWG	mm^2	AWG	mm^2
Up to 3 m (10 ft.)	12	2,5	12	2,5
Up to 6 m ((20 ft.)	10	4	10	2,5
Up to 10 m (32 ft.)	8	6	10	4
Up to 16 m (52 ft.)	6	10	8	6

4.9 Grounding and RFI

The autopilot system has excellent RFI protection and all units use the Junction Unit as a common ground/shield connection. The Junction Unit should therefore have a proper ground connection to the hull/bonding system.

ROBNET cables and other signal cables (compass, feedback, NMEA) should not be run in parallel with other cables carrying RF or high current, such as VHF and SSB transmitters, battery chargers/ generators, winches and thrusters.

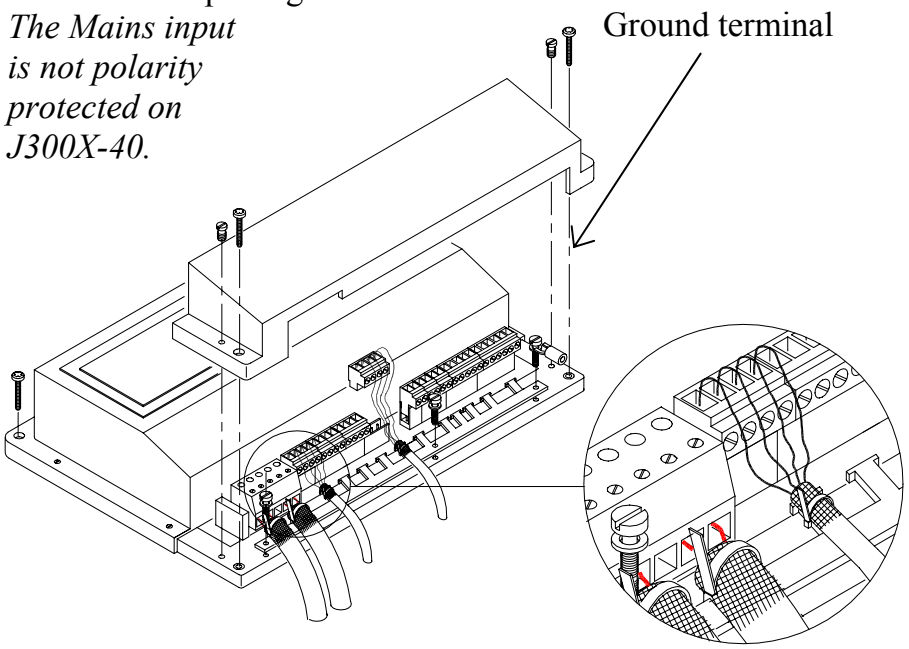
Remove the bottom cover to get access to the plug-in terminals. Strip about 1 cm (0.4") of the cable's insulation and pull the screen backwards to cover the insulation. Position the straps as shown and tighten well to make sure the screen has good contact.

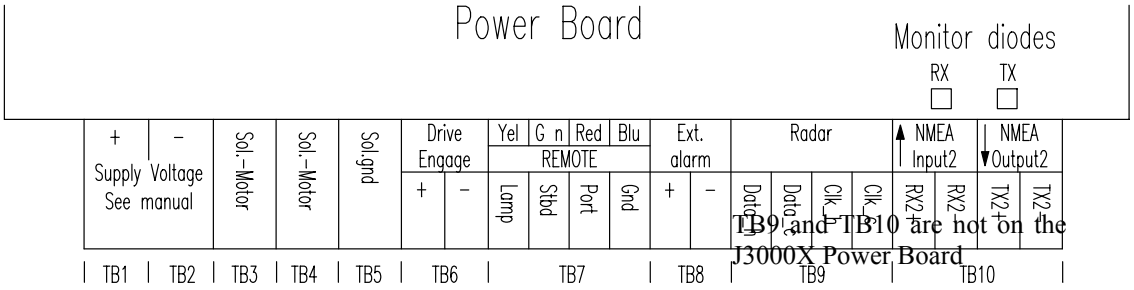
Provide sufficient wire length so that the plug-in terminals can be easily connected/disconnected.

Pull out each terminal before connecting the wires. Remove all strands before putting on the terminal cover

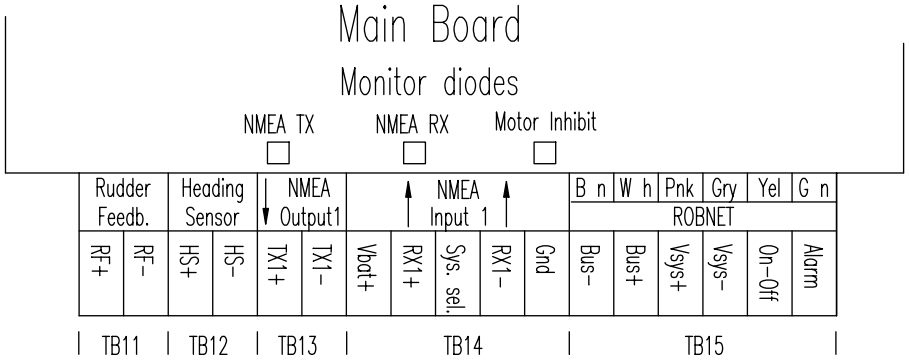
Note!

The Mains input is not polarity protected on J300X-40.





Power Board terminals



Main Board terminals

4.10 Drive unit installation

The relation between drive units, drive unit voltage, input voltage, drive output and interfacing to steering gear are shown in the table below. The AP20 system detects whether a reversible motor or a solenoid is connected and outputs the correct drive signal automatically.

Refer to the connecting diagram for the different drive units on page 60 onwards.

Installation instruction for the drive units are found in the manual for the individual units.

The maximum drive current capability of the J3000X, J300X and J300X-40 junction units are different. Use the table below as reference and observe the notes on next page.

HYDRAULIC PUMPS

MODEL	MOTOR VOLTS	JUNCTION UNIT	RAM CAPACITY		FLOW RATE AT 10 bar cm^3/min (cu. in/min)	MAX PRESSURE bar	PWR. CONSUM-PTION
			MIN cm^3 (cu. in.)	MAX cm^3 (cu. in.)			
RPU80	12V	J3000X	80 (4,9)	250 (15,2)	800 (49)	50	2,5-6 A
RPU160	12V	J300X	160 (9,8)	550 (33,5)	1600 (98)	60	3-10 A
RPU200	24V	J300X	190 (11,6)	670 (40,8)	2000 (122)	80	3-10 A
RPU300	12V	J300X-40	290 (17,7)	960 (58,5)	3000 (183)	60	5-25 A
RPU300	24V	J300X	290 (17,7)	960 (58,5)	3000 (183)	60	2,5-12 A
RPU3	24V	J3000X	370 (22,4)	1700 (103)	3800/5000 (232/305)	40	7-22 A
RPU1	12V	J3000X	140 (8,5)	600 (36,6)	1400/2000 (120/185)	40	7-22 A

Steering gear interface: Hydraulic plumbing

LINEAR DRIVE UNITS

MODEL	MOTOR VOLTS	JUNC-TION UNIT	MAX STROKE mm (in.)	PEAK THRUST kg (lb.)	MAX RUDDER TORQUE Nm (lb.in.)	HARD-OVER TIME sec. (30% load)	PWR. CON-SUMP.	TILLER ARM mm (in.)
MLD200	12V	J3000X	300 (11,8)	200 (440)	490 (4350)	15	1,5-6 A	263 (10,4)
HLD350	12V	J3000X	200 (7,9)	350 (770)	610 (5400)	12	2,5-8 A	175 (6,9)
HLD2000L	12V	J300X	340 (13,4)	500 (1100)	1460 (12850)	19	3-10 A	298 (11,7)
HLD2000D	24V	J300X	200 (7,9)	1050 (2310)	1800 (15900)	11	3-10 A	175 (6,9)
HLD2000LD	24V	J300X	340 (13,4)	1050 (2310)	3180 (28000)	19	3-10 A	298 (11,7)
MSD50*	12V	J3000X	190 (7,5)	60 (132)	–	15	0,8-2 A	–

Steering gear interface: Connects to quadrant or tiller.

* For stern drive power assisted steering only.

1. *The motor voltage is stepped down by the junction unit when operating from 24V or 32V mains (except for RPU1 and RPU3).*
2. *The specified junction unit is necessary to achieve max drive unit capacity.*
3. *Recommended operational thrust or torque is 70% of listed value.*
4. *Typical average power consumption is 40% of listed maximum value.*

PREVIOUS MODELS DRIVE UNITS

Model	Motor voltage	Junction unit	Drive output	Interface to steering gear
RPU100, RPU150, (Reversible hydraulic pump)	12V	J300X	Proportional rate	Hydraulic plumbing
MRD100 (Reversible mechanical drive)	12V 24V	J300X	12V to clutch 24V to clutch Proportional rate to motor	Chain/ sprockets
MRD150	12V 32V	J300X	12V to clutch 32V to clutch Proportional rate to motor	Chain/ sprocket

Note ! *When selecting **DRIVE UNIT** voltage in the Installation setup, the clutch/bypass voltage is always set equal to the motor voltage. If a retrofit installation where e.g. a HLD2000 has a 12V motor and a 24V bypass valve, the bypass valve solenoid has to be changed back to standard 12V version.*

Connecting a reversible pump

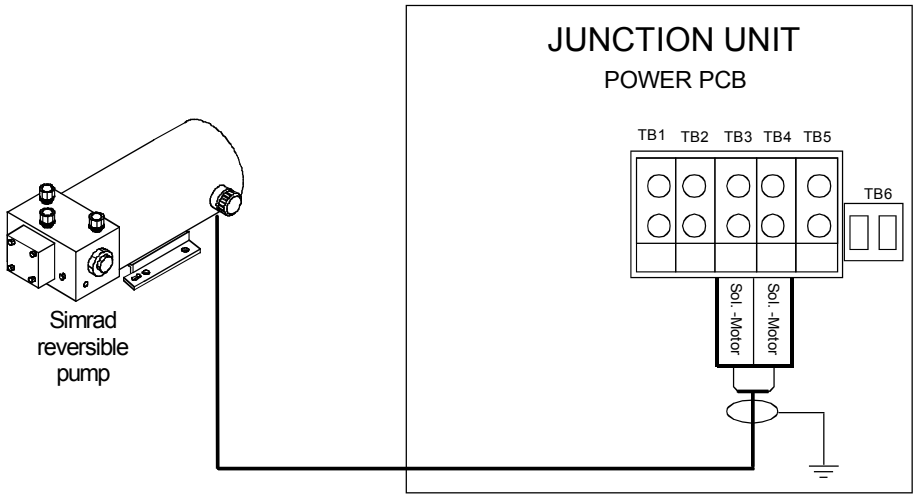


Figure 4-5 Connecting a reversible pump

Connecting a hydraulic linear drive

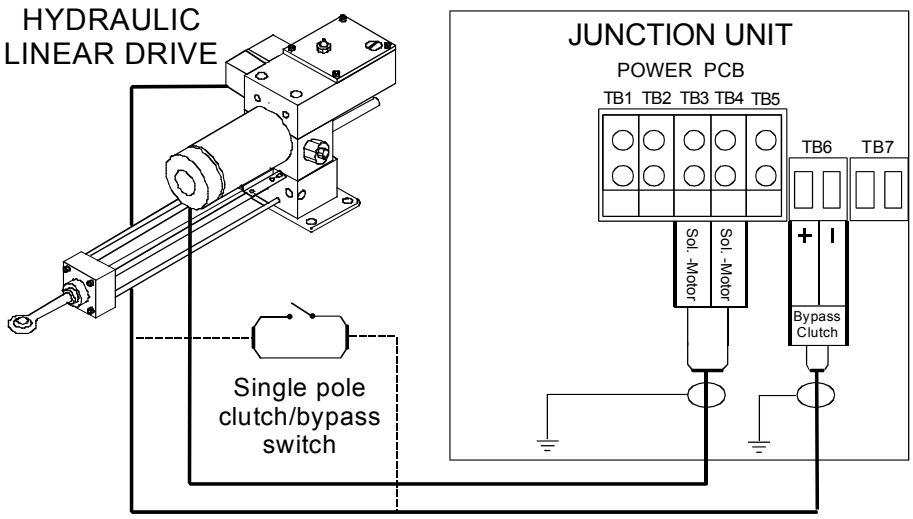


Figure 4-6 Connecting a hydraulic linear drive

Connecting a solenoid valve

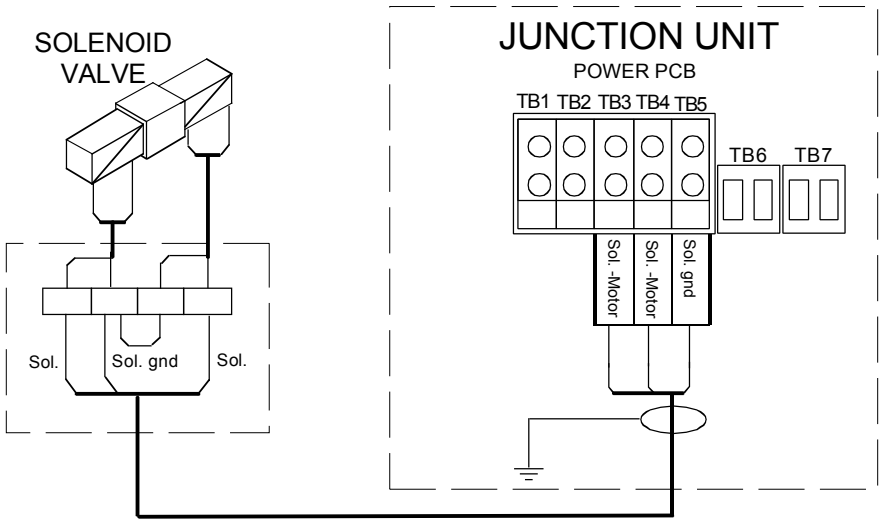
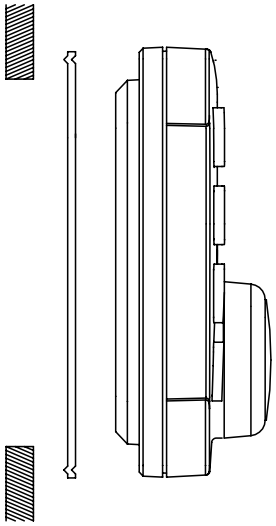


Figure 4-7 Connecting a solenoid valve

4.11 Control unit installation

Avoid mounting the control unit(s) where it is easily exposed to sunlight, as this will shorten the lifetime of the display. If this is not possible, make sure the units are always covered with the white protection cover when not used.

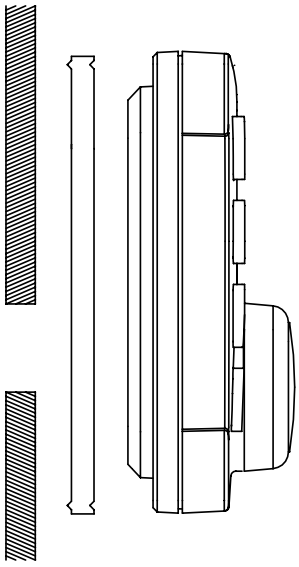
Panel mounting



The mounting surface must be flat and even to within 0.5 mm.

- Drill the 4 mounting holes and make a panel cut-out according to supplied template.
- Use the supplied gasket (P.N. 22084693) between the panel and the unit.
- Use the supplied 19 mm screws to fasten the control unit to the panel.
- Apply the front panel corners.
- Connect the Robnet cable(s) to the control unit connector(s) **(See note on page 64).**

Alternative panel mounting



Note !

This way of mounting is simpler, but will lift the unit from the panel surface. When installed adjacent to Simrad MarineLine equipment there will be a 5,5 mm (0,22") difference in height between the autopilot and the other equipment.

- Use the template and drill hole(s) only for the connectors.
- Place the thick gasket (P.N. 22086029) between panel and unit, correctly orientated (see marking on gasket).
- Follow above panel mounting instructions but use the supplied 32 mm screws to fasten the control unit to the panel

Do not over-tighten the mounting screws!

Optional bracket mounting

- Locate the cradle on the mounting site and mark the 4 holes for the fixing screws on the mounting surface.
- Drill the 4 mounting holes and screw the cradle to the mounting surface.
- Use the supplied screws to fasten the control unit to the left and right brackets.
- Apply the front panel corners.
- Use the two locking knobs to assemble the cradle with the left and right brackets and adjust the control head to best viewing angle.
- Connect the Robnet cable(s) to the control unit connector(s) **(See note on page 64).**

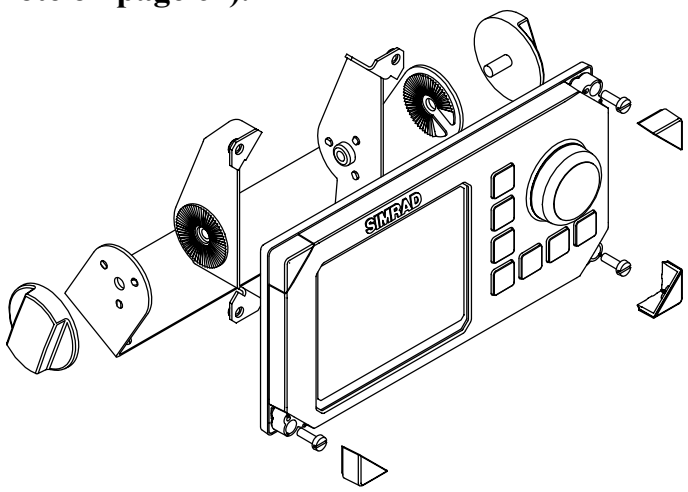


Figure 4-8 AP20 Bracket mounting

4.12 ROBNET network cables

As Robnet units have 2 Robnet connectors they can be used as "jack points" for further expansion of the system. There are no dedicated "in" or "out" connectors. You may connect the cables to any available Robnet connector on the specific unit.

The Robnet cables are available in 7 and 15 m length and provided with 6 pin male connector at one or both ends. The 15 m cable to the junction unit has connector only at the control unit end.

Optional extension cable (10 m) is available and has a male and a female connector.

When installing a system, try to minimize total Robnet cable length by connecting all Robnet units to the nearest available Robnet connector.

Total length of Robnet cable installed in a system should not exceed 50 m (165').

Examples of interconnecting Robnet units:

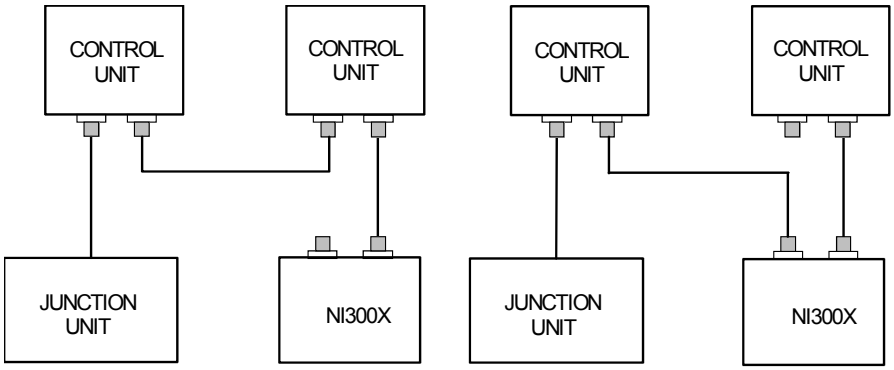


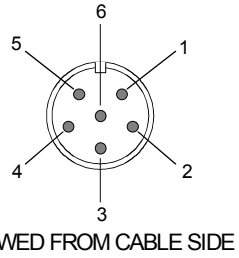
Figure 4-9 Interconnecting Robnet units

All connectors are crimp type. These can be easily disassembled, if desired for ease of installation.

See table for pin configuration and colour code of the network cable. DO NOT MIX THE PINS AND THE CABLE COLORS!

Note ! *Apply a thin layer of pure Vaseline on the connector threads and make sure the connectors are properly secured to the receptacle by the coupling ring. The connectors are weather proof according to IP56, when properly installed. All unused Robnet plugs must be fitted with the plastic cap to keep the connector free of dirt and moisture. A separate screw cap for the Control unit comes as part of the installation kit.*

Cable pairs	Color code	Pin	Signal
1. pair	Pink	5	V SYSTEM+
	Grey	4	V SYSTEM–
2. pair	Brown	1	Bus–
	White	2	Bus+
3. pair	Yellow	3	On - Off
	Green	6	ALARM



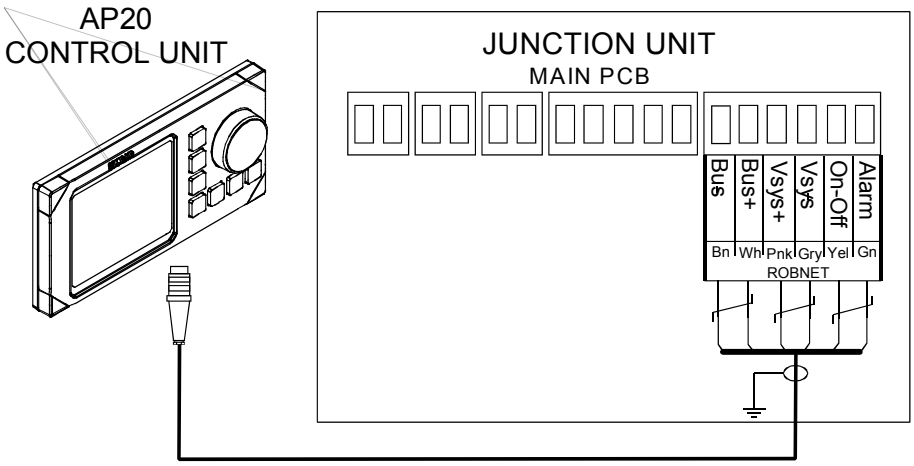
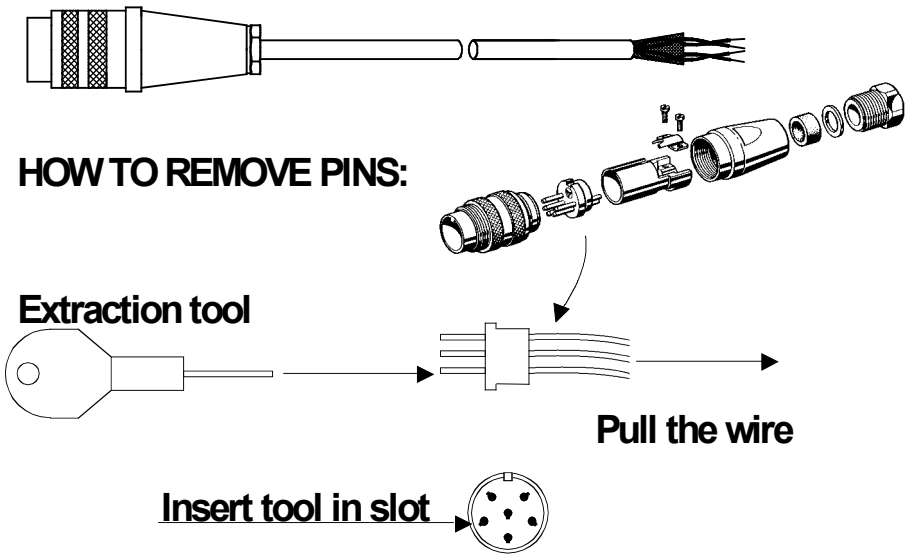


Figure 4-10 Control unit connection



Note ! *For installations that require special cable length, contact your Simrad distributor for information.*

AP21 connection

If a Simrad AP21 is part of the system, use the Robnet connector in a free receptacle (see Figure 4-9). Alternatively cut the connector from the cable and connect the wires in parallel with the cable shown on Figure 4-10 using the same colour code.

Note ! *The AP21 cable contains an air-breathing tube. Check that the tube is open after you have cut the cable.*

4.13 RFC35 Fluxgate Compass installation

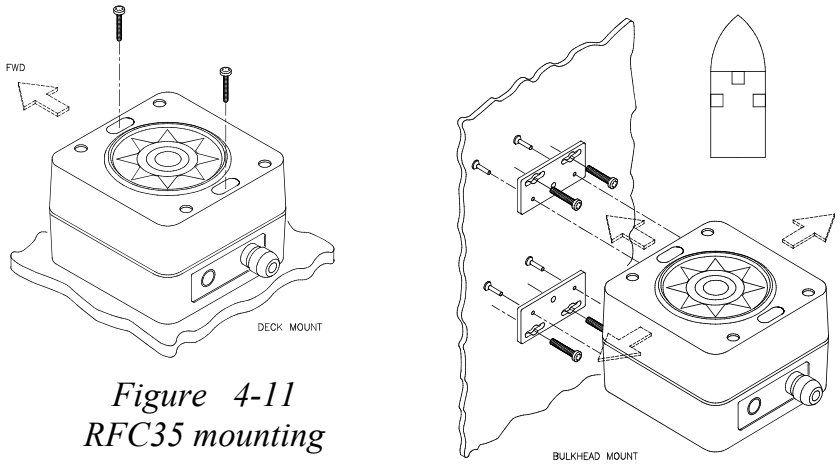


Figure 4-11
RFC35 mounting

The heading sensor is the most important part of the AP20 system and great care should be taken when deciding the mounting location. As the heading is displayed on the AP20 Control Unit, the heading sensor can be mounted at a remote location.

Note ! *An autopilot fluxgate compass or magnetic compass should not be installed on the fly bridge or in the mast.*

The RFC35 compass can be mounted on deck or bulkhead, athwartship or alongship. The heading offset feature in the AP20 will compensate for the mechanical offsets that may be a result of the selected location and orientation of the RFC35.

If the RFC35 is deck or bulkhead mounted athwartship with the cable gland pointing aft, little if any offset correction is required. With the cable gland pointing forward a 180° correction is required.

When mounting RFC35 on a bulkhead alongship, a +90° or –90° correction is needed dependent on whether it is port or starboard bulkhead.

Note ! *Offset correction is performed after the calibration (see paragraph 4.32).*

Find a location that provides a solid mounting place free from vibration, and as close to the vessel's centre of roll and pitch as possible, i.e. close to the water line. It should be as far as possible from disturbing magnetic influences such as the engines (min. 2 meters), engine ignition cables, other large metal objects and particularly the drive unit.

Use the supplied mounting kit and drill the holes through the centre of the slots in the sensor or the mounting brackets.

Note ! *The compass face plate on the RFC35 is the TOP. Never mount it upside down! Level the sensor as close to horizontal as possible.*

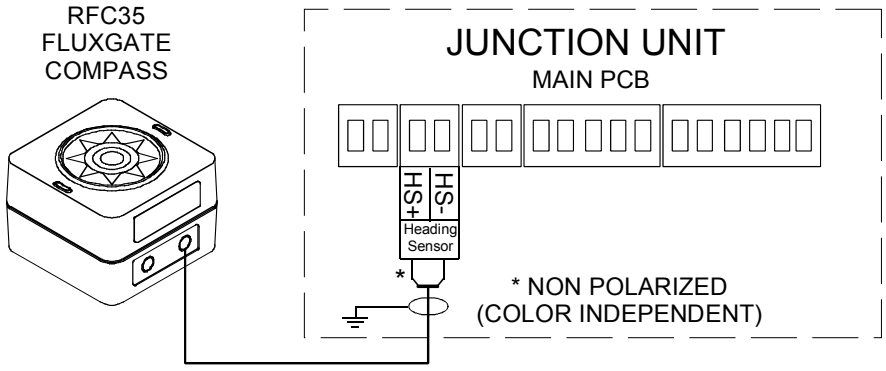


Figure 4-12 RFC35 connection

- Select RFC = J300X in the Installation Interface Set-up
- Select RFC as compass in the User Set-up menu

4.14 RFC35R Rate Compass installation

The RFC35R Rate Compass also contains a magnetic fluxgate sensor, which means you have to take the same precautions at installation as for the standard RFC35 (see previous page). On steel hull boats, however, it should be installed 1 meter above the steel deck to obtain optimum performance.

- Connect the Robnet connector to the AP20 Control Unit (or CI300X or NI300X if installed).

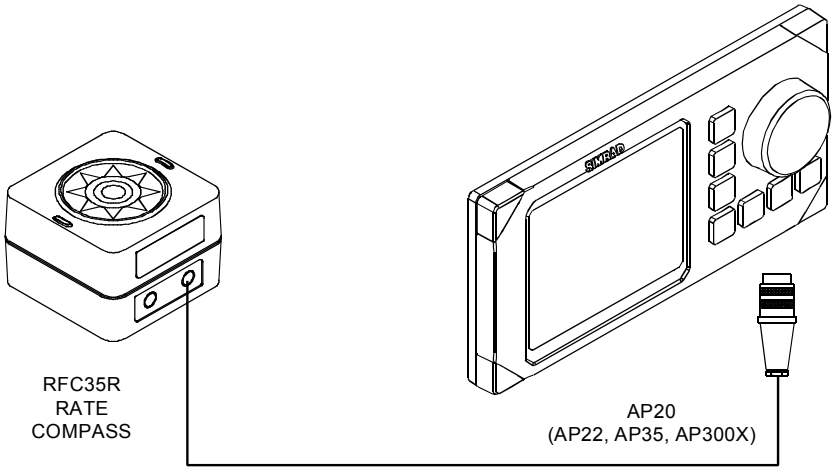


Figure 4-13 RFC35 connection to autopilot control unit

- Alternatively, if there is no free receptacle, cut the connector from the cable and connect the wires in parallel with the wires going from the junction unit to the control unit. *Do not connect the yellow and the green wire, but secure them from connection to the terminal or chassis.*

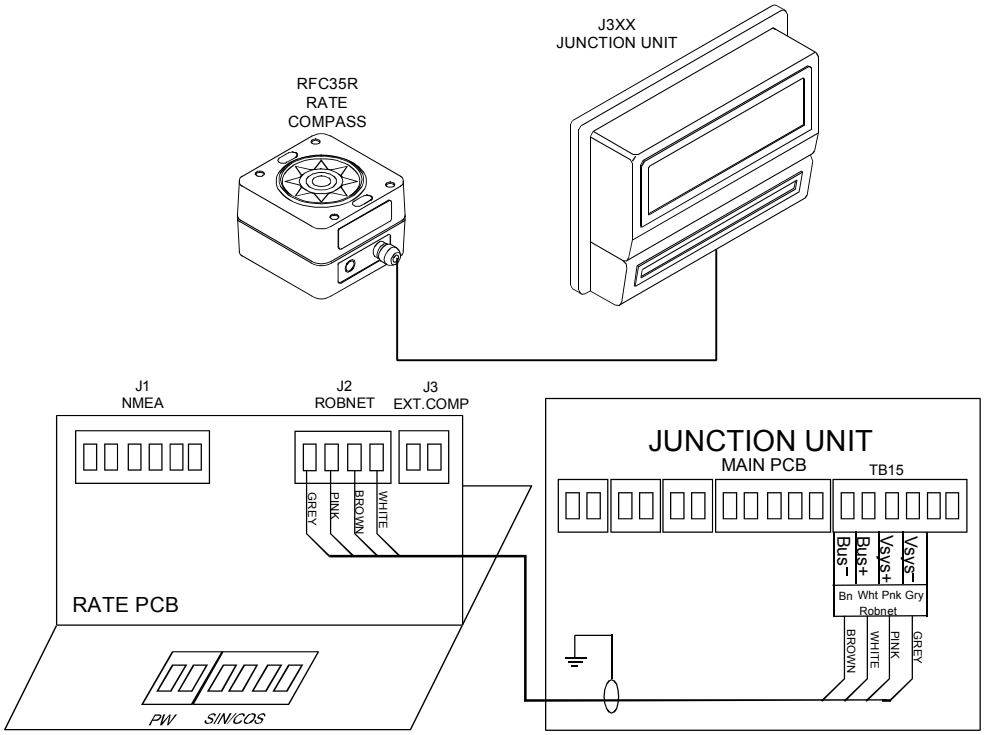


Figure 4-14 Alternative connection to J3XX Robnet terminal

- Select RFC = ROBNET in the Installation:Interface Setup.
- Select RFC as compass in the User Setup Menu.
- Perform the compass calibration as described on page 97.

Note ! *After turn on the compass will stabilize in less than 30 seconds, but it will need another 10 minutes to get the full effect of the rate sensor.*

Refer to page 98 to compensate for any permanent off-set after the calibration is completed.

RFC35R calibration data is stored in the compass and will not be deleted by a Master Reset in the autopilot. Offset compensation, however, must be reset.

4.15 R3000X Remote Control installation

R3000X should be mounted in the supplied bracket that can be fixed by four mounting screws. The unit is weather proof and can be mounted outdoor.

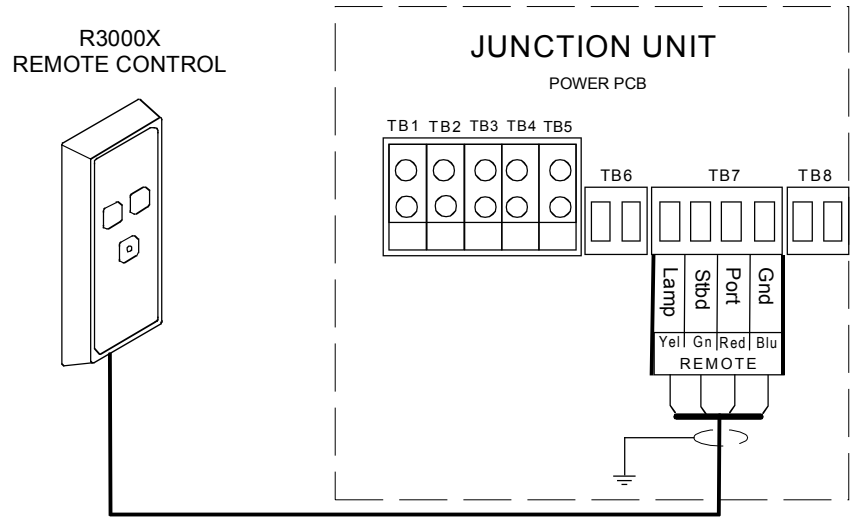


Figure 4-15 R3000X connection

4.16 S35 NFU Lever installation

The unit is mounted to bulkhead or panel by two screws from the front. The cable is connected to the junction unit according to Figure 4-16. Interchange the port and stbd wires to the screw terminals in the junction unit if necessary to make the direction of the lever movement coincide with the direction of the rudder movement.

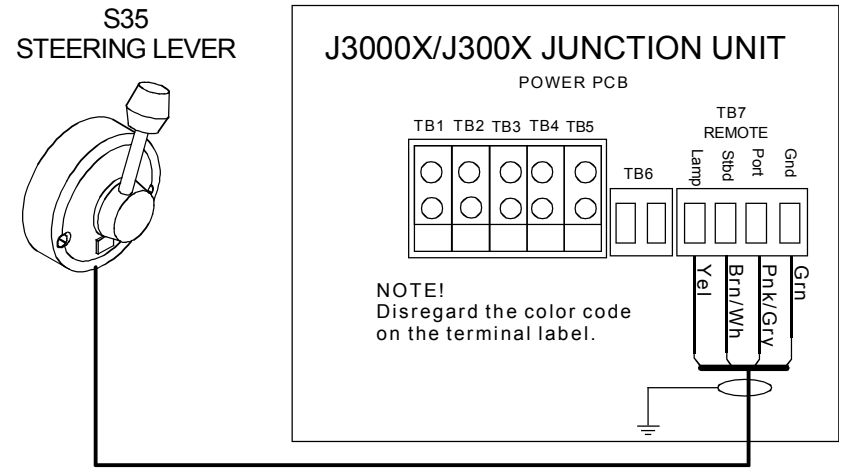


Figure 4-16 S35 connection

The unit is opened by removing the three screws on the back cover. Inside are two sets of micro-switches, a printed circuit board with a plug-in terminal and a jumper strap.

4.17 Interfacing

With the AP20 autopilot system there are several possibilities to connect to other equipment for data exchange:

1. J3000X includes a single NMEA input/output port.
2. J300X includes two NMEA input/output ports and Clock Data interface to Anritsu and Furuno radars.
3. The optional NI300X NMEA Interface (expansion) Unit with 4 additional NMEA input/output ports.

The NMEA output may also drive IS15 instruments directly.

The different connecting diagrams below illustrate the interface possibilities.

Note ! *See also Interface Setting, page 90.*

4.18 Single NMEA input/output

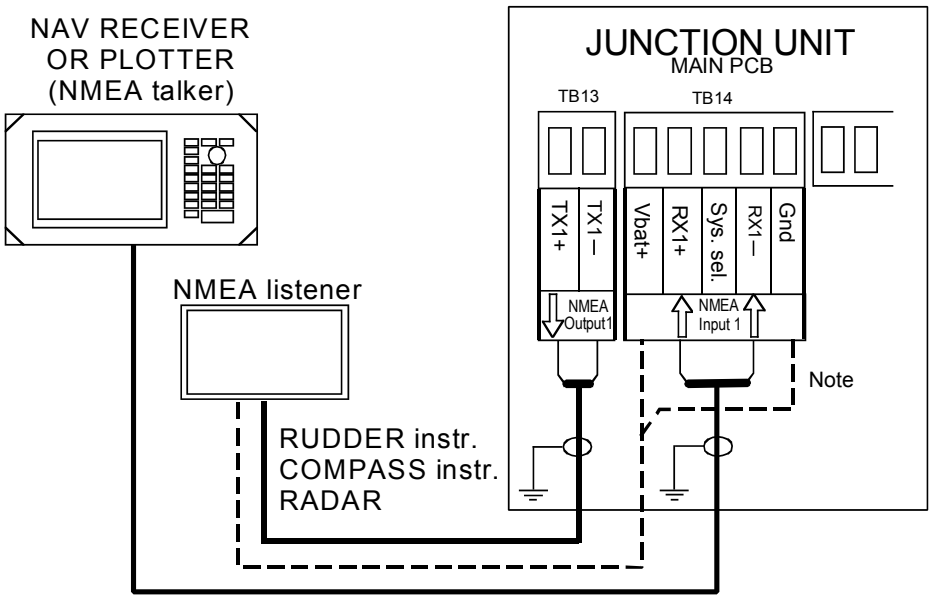


Figure 4-17 Single NMEA connection

Note ! *If an IS15 Instrument is powered from TB14 Vbat+ and Gnd, please observe that Vbat output voltage will follow mains supply voltage (IS15 Compass = 12V only!).*

4.19 Double NMEA input/output

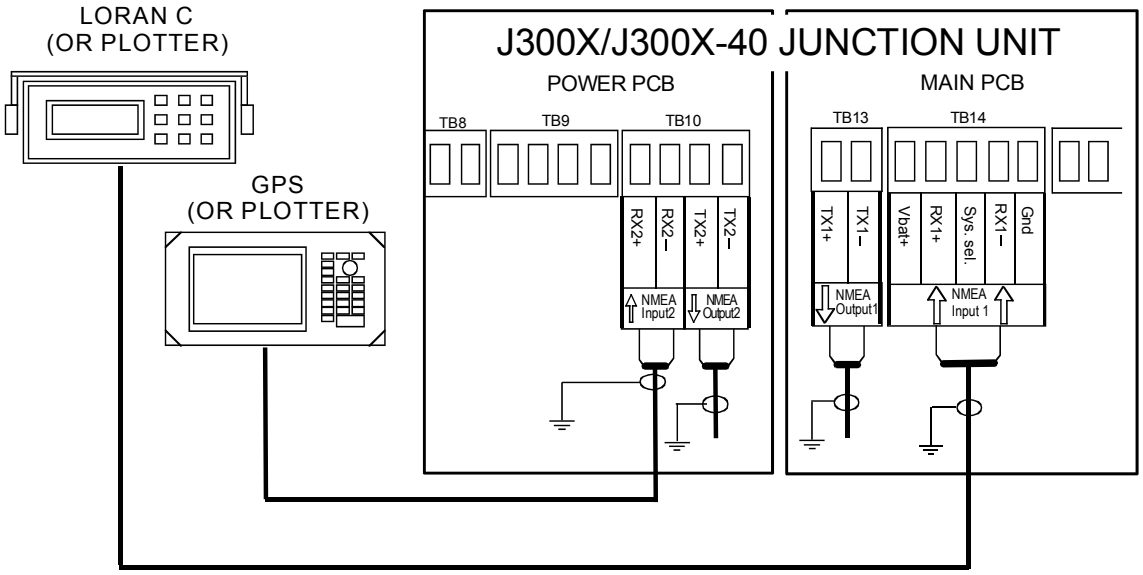


Figure 4-18 Double NMEA connection

4.20 Additional NMEA output on Port 2

(Applies for AP20 V1R3/J300X V1R8 onwards)

Output signal	Output terminal	Output sentence
Continuous output of compass heading on 10 Hz (10x/sec.) NMEA format	Junction unit, Power PCB, NMEA2, TX2+, TX2–	HDT (True) or HDG (Magn.) depending on heading source.

4.21 NMEA Compass in

(Applies for AP20 V1R3/J300X V1R8 onwards)

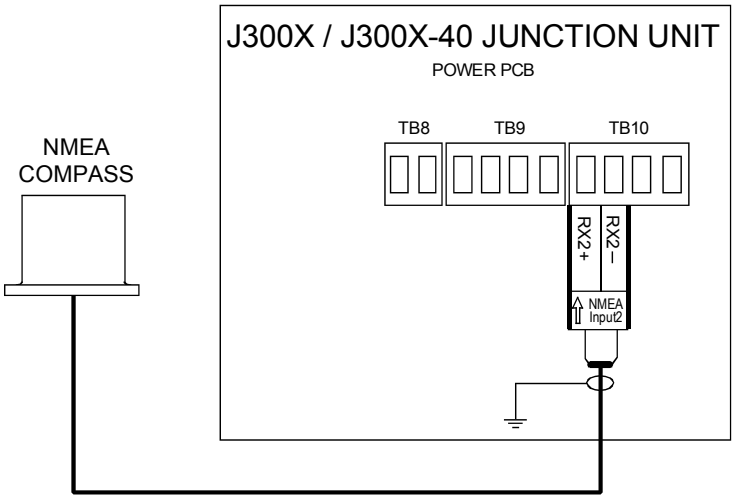


Figure 4-19 NMEA compass connection

4.22 Radar Clock/Data

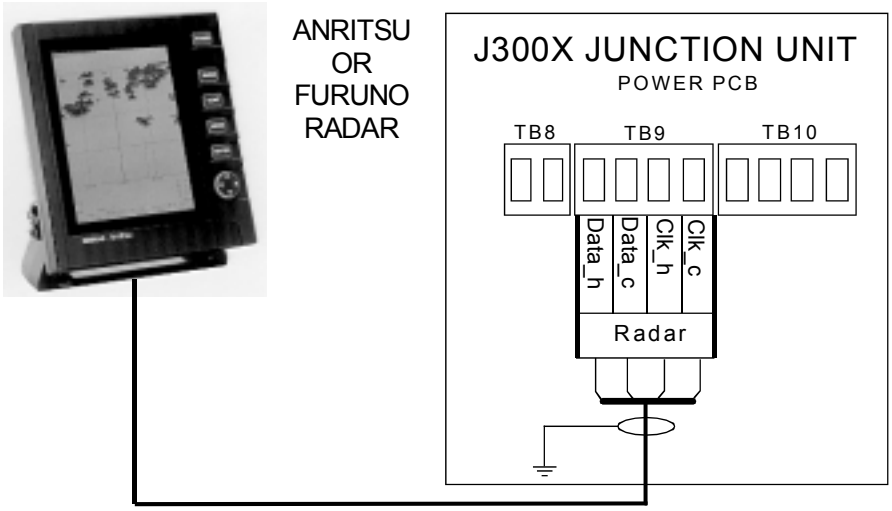


Figure 4-20 Radar Clock/Data connection

4.23 IS15 Instrument installation

For installation and operation of the IS15 instruments refer to separate manuals.

NMEA In

This connection will provide speed, depth and temperature input to the autopilot. If an IS15 Wind Transducer is connected to the system, wind information will also be transferred to the autopilot.

The connection is made by a Roblink cable from the instrument NMEA socket (4) to the J3xx Junction Unit Main Board, Terminal RX1+ and RX1-. See Figure 4-21.

NMEA Out

This will provide the instrument system with heading data.

The connection is made by a Roblink cable from J3xx Junction Unit Main Board, terminal TX1+ and TX1– to the instrument NMEA socket (4). See Figure 4-21.

You will need a minimum of two instrument heads to make the system both ‘listen’ and ‘talk’ (I/O).

If IS15 Expander is used in the instrument system, the NMEA connections are made to this unit. See Figure 4-22.

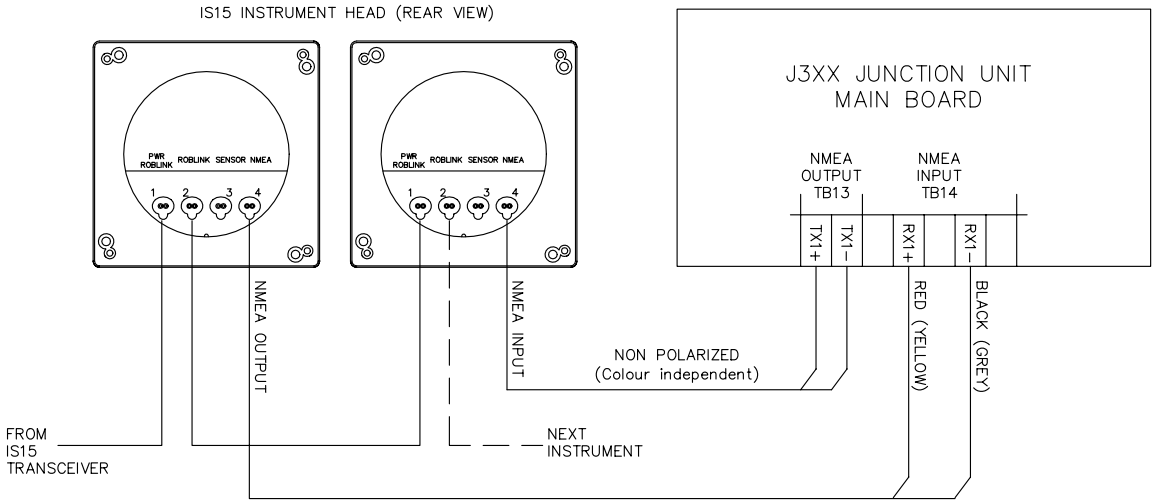


Figure 4-21 IS15 Instruments / J3XX Connection

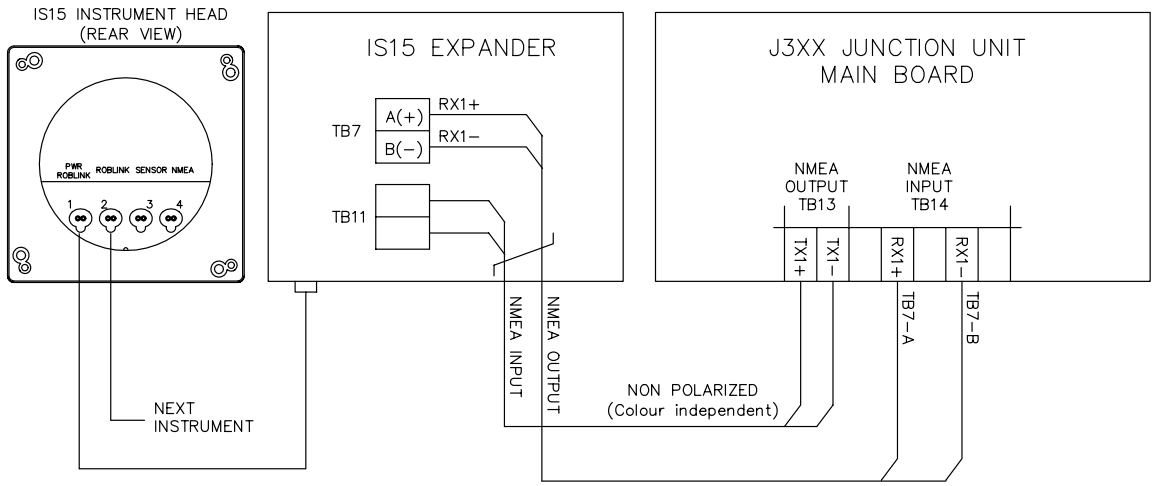


Figure 4-22 IS15 Expander / J3XX Connection

4.24 External Alarm

The external alarm circuit has an open collector output for an external alarm relay or buzzer. The operating voltage for the circuit is the main supply voltage. Max. load on external alarm output is 0.9 Amp.

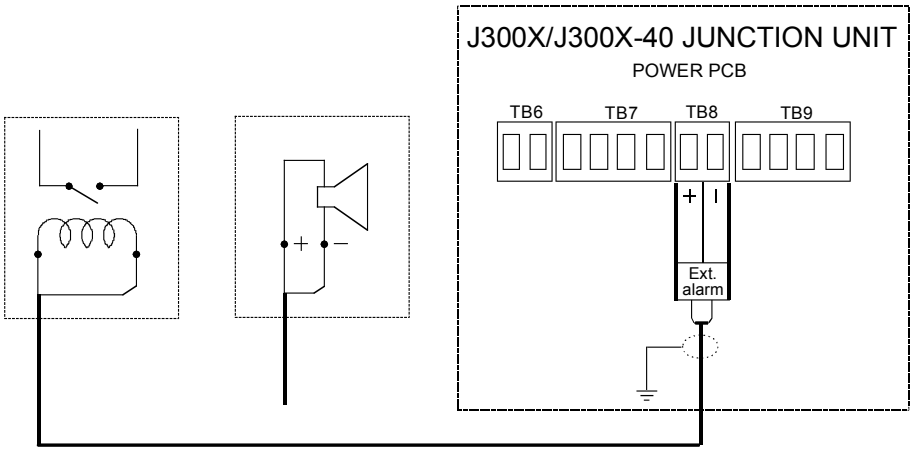


Figure 4-23 External alarm connection

4.25 NI300X NMEA Interface Unit

The NI300X is normally installed inside a console or locker close to Nav receivers, radar and instruments to keep cables short. The unit does not have controls that need to be operated during installation or use, but you should be able to take the lid off for inspections, to view LED indication of received signals. It should be installed with the cable inlet and the Robnet connectors facing down. The NI300X is designed to operate in a location that provides ambient temperatures below +55°C (+130°F). It is fastened to the panel/bulkhead by the external mounting brackets.

Note ! *The NI300X is not weatherproof, and must be installed in a dry location!*

The NI300X NMEA Interface (expansion) Unit is designed to handle installations where more NMEA lines have to be tied into the system. Four NMEA ports are available. An additional output data-port with DATA/CLOCK signal is capable of generating heading data in the format used by some radar displays made by Anritsu and Furuno. This feature is thus added to the system if a J3000X Junction Unit is installed (J3000X has

no radar Clock/Data output as compared to J300X and J300X-40).

Configuration for Anritsu or Furuno is selected in the Installation Menu.

12V out can drive max. 2 IS15 instruments (max 250mA load), e.g. “Rudder” and “Compass”.

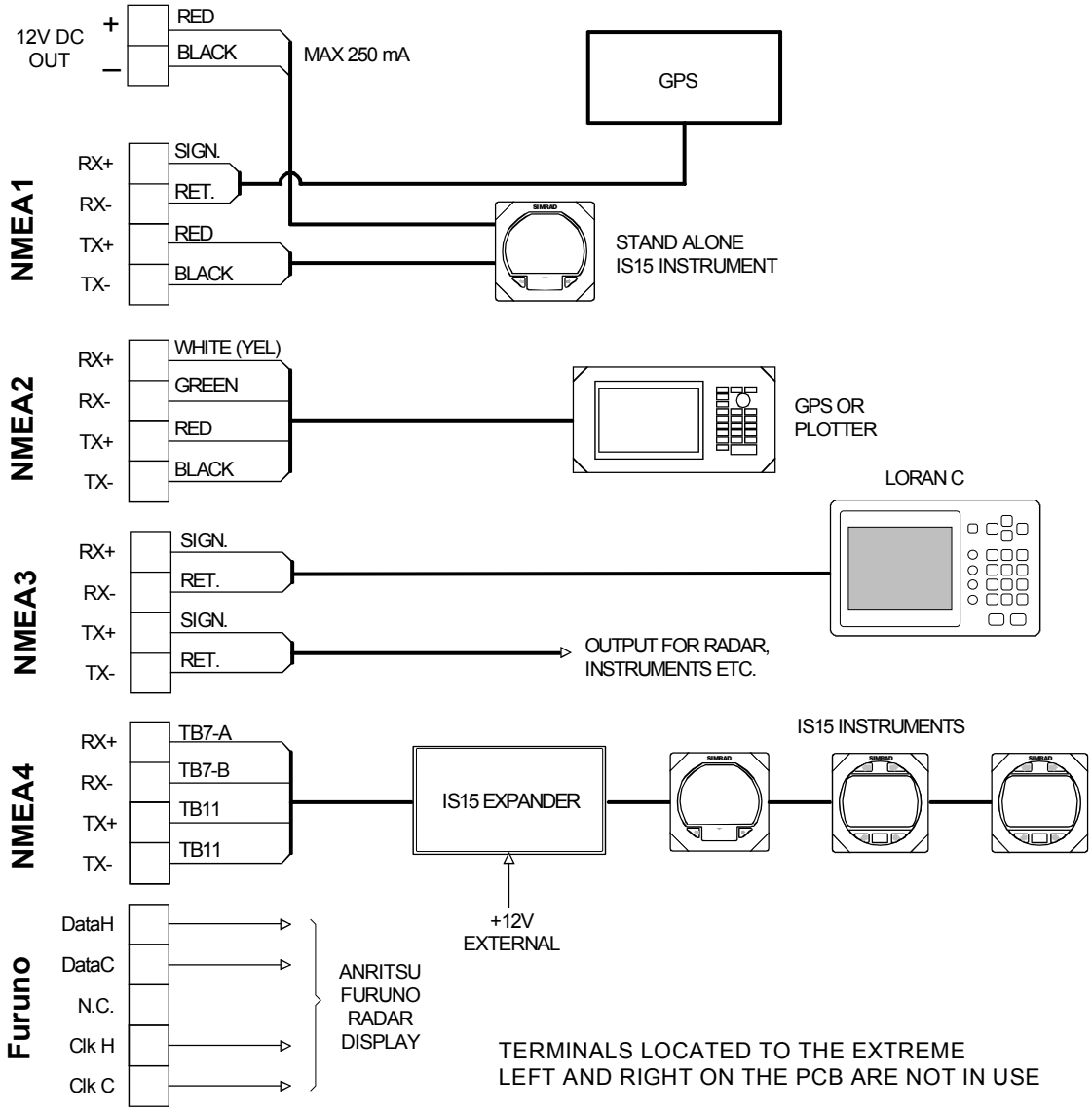


Figure 4-24 NI300X connection

The NMEA 1-4 ports are identical in HW and SW and can be connected as desired.

4.26 CI300X Analogue Interface Unit

The CI300X analogue interface unit is an optional module, designed to enable a variety of different equipment to connect into AP20 systems. The CI300X converts the analogue inputs into Robnet compatible signals for use by AP20 system components. The CI300X adds the following capabilities to the AP20 system, and allows connection of each of the following simultaneously:

- Magnetic compass connection with CD100A course detector.
- Gyrocompass connection for Simrad RGC50, RGC10
- Analogue input of SIN/COS for either one of the following:

– Fluxgate compass connection (for other manufacturers SIN/COS fluxgate compasses)

– Analogue windvane (SIN/COS)

For detailed information, see separate CI300X Manual

Note ! *If an analogue wind vane is connected to the system via CI300X, the Interface setup must be set accordingly (see page 94). Furthermore a calibration must be performed. Access to the calibration display is automatic and follows the compass calibration (see page 97). The calibration procedure is similar to the compass calibration, but will normally take 3 full turns.*

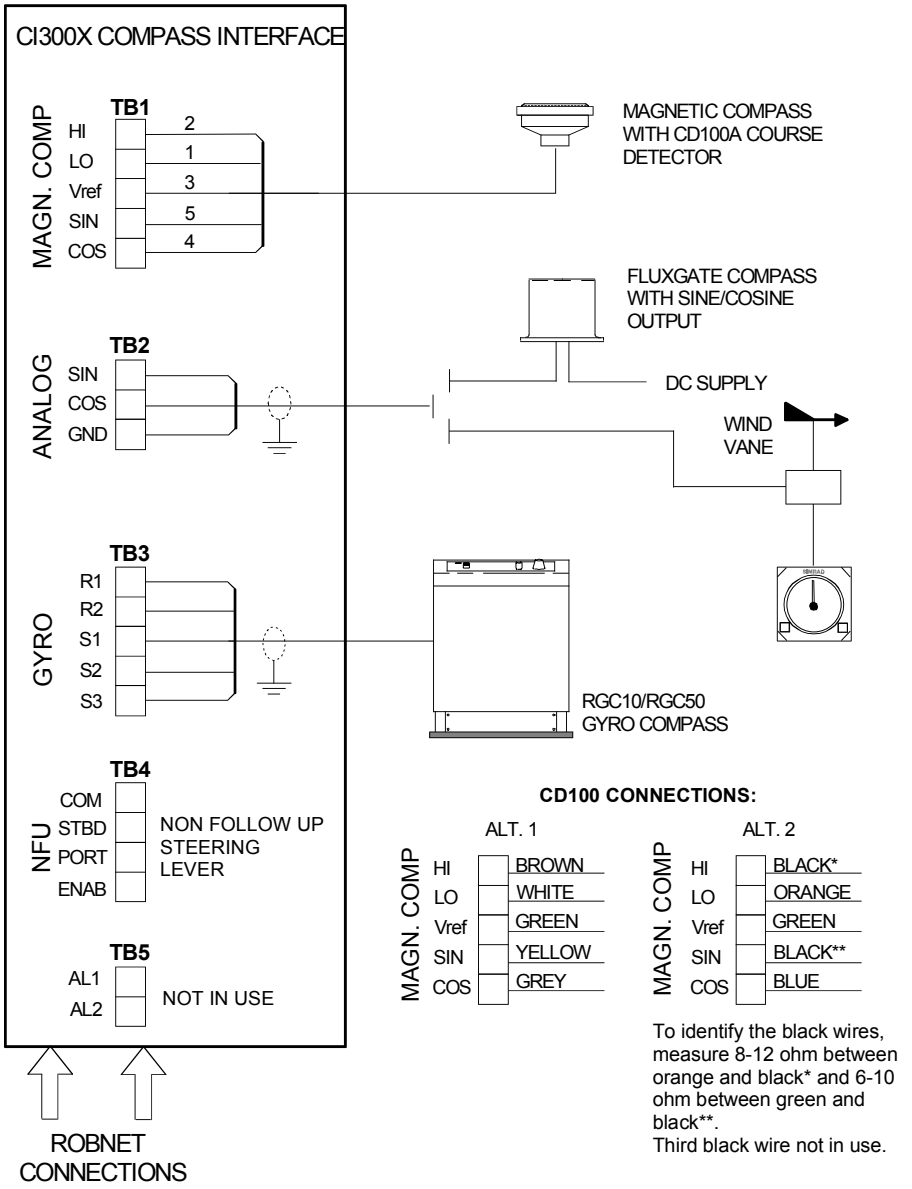


Figure 4-25 CI300X Interconnections

Note ! *CD100 has a connector that has to be cut off the cable.*

4.27 LF3000 Linear Feedback

Note ! *The rod of the LF3000 is not locked in place in the cylinder. If caution is not exercised it may slip out of its housing and end up over the side, so be careful!*

The LF3000 is a waterproof feedback unit. It has a 300 mm (11,8") stroke and comes with a special mounting bracket which secures the LF3000 to the cylinder of the existing outboard drive unit.

The 8,5 m (28') cable is terminated in the LFI3000 Mk2 Linear Feedback Interface according to the wiring diagram.

Center the drives. Loosely secure the LF3000 to the supplied mounting bracket, across the center of the drive unit cylinder. Either cylinder may be used if there is a dual set up. You may mount the feedback in either direction, i.e. the shaft of LF3000 may point to port or starboard.

Loosen the end bolt (a) used to secure the cylinder to the drive unit mount. Insert the rod retaining assembly (b) (end plate) and retighten this bolt. Secure the feedback rod to the end plate using the two washers and cap nut provided. Adjust the location of the LF3000 Linear Feedback to allow full travel of the hydraulic cylinder without causing the endplate of the LF3000 hitting the end of the cylinder. Check that the outboard motor can be tilted freely. Tighten all nuts and the mounting bracket.

Turn the helm slowly by hand to the stops on either side, making sure that the rod does not bind up in any direction. Also, clamp cable to allow full engine movement to port and starboard. The mounting hardware provided with this system is meant to interface with Teleflex HC5340 cylinders and Hynautic K7 and K10 Cylinders. If you are attempting to interface to another system the hardware enclosed may not be appropriate!

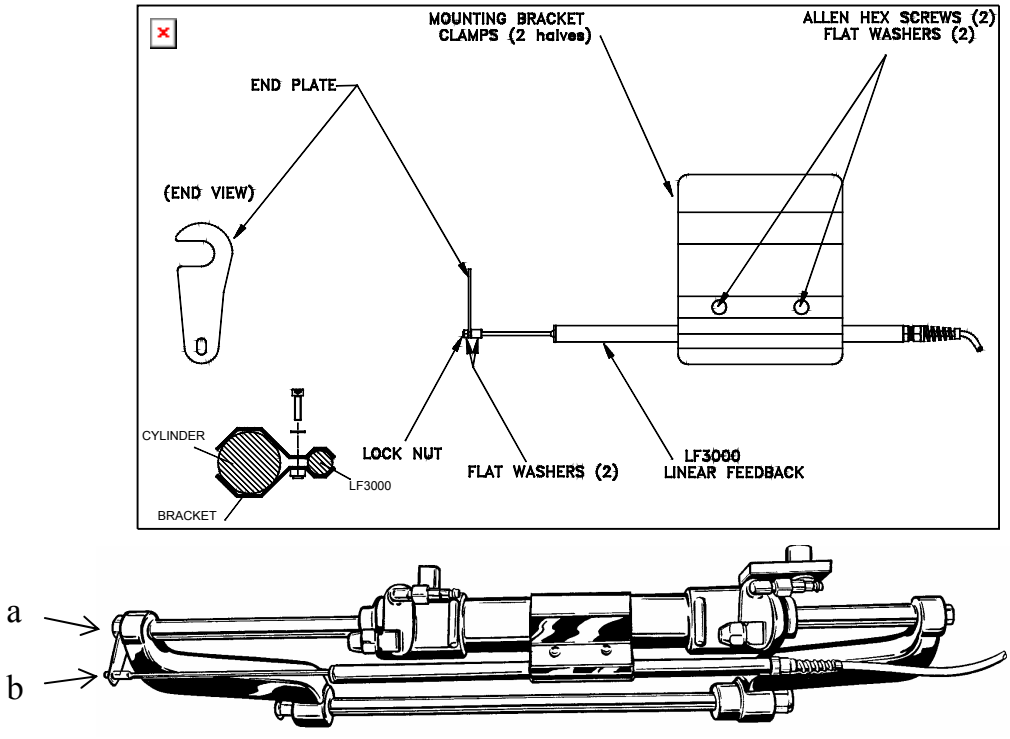


Figure 4-26 LF3000 mounting

Electrical connection

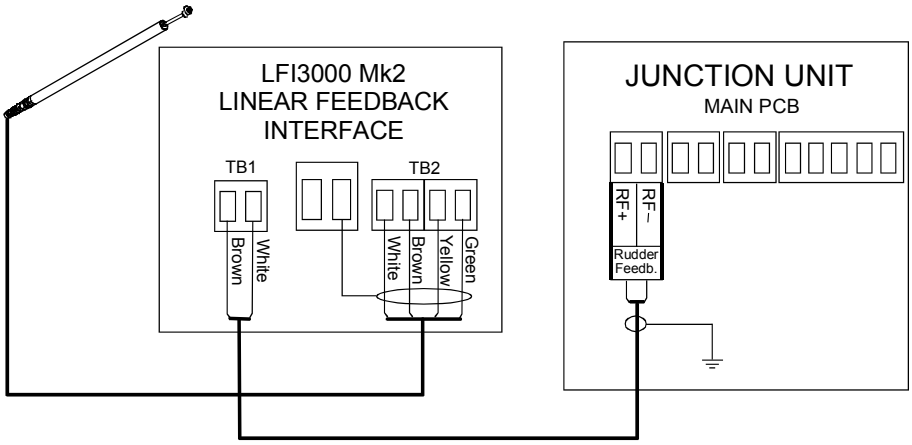
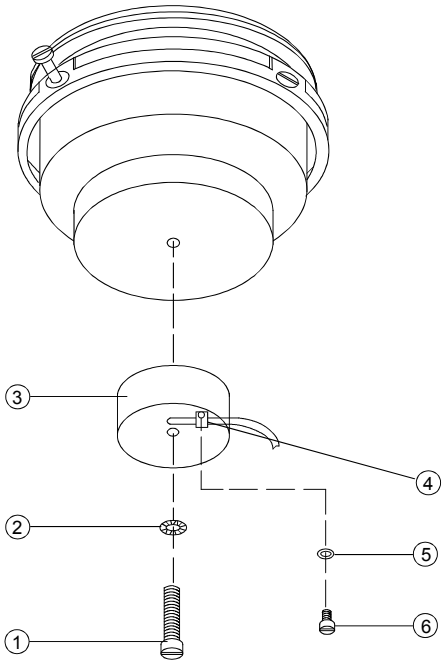


Figure 4-27 LF3000/LFI3000 Mk2 connections

Note ! *The previous LFI3000 had no centre block terminal for screen termination.*

4.28 CD100A Course Detector

On some installations the owner may prefer to use the boats own compass. The compass must be fully gimballed and have a flat surface underneath to fit the CD100A. Make hole for a 6 mm screw in the bottom of the compass and mount the CD100A as shown on the drawing. Secure the 6 mm screw through the centre hole of the CD100A. Make sure the cable does not prevent the compass from moving freely in the gimbals.



1	Screw M6x25mm, non magnetic
2	Washer, non magnetic
3	Course detector
4	Cable clamp, nylon
5	Washer, non magnetic
6	Screw M3x10mm, non magnetic

Note!
Lock nut on mounting screw (pos. 1) for transportation only. To be removed before mounting.

Figure 4-28 CD100A mounting

4.29 CDI35 Interface

Locate the CDI35 as close to the compass as possible so that there will be no problem finding it in the event of a service.

Put the two fixing screws in the slots and secure the unit to the bulkhead. Open the unit to access the screw terminals.

Connect the cables as shown on the diagram below.

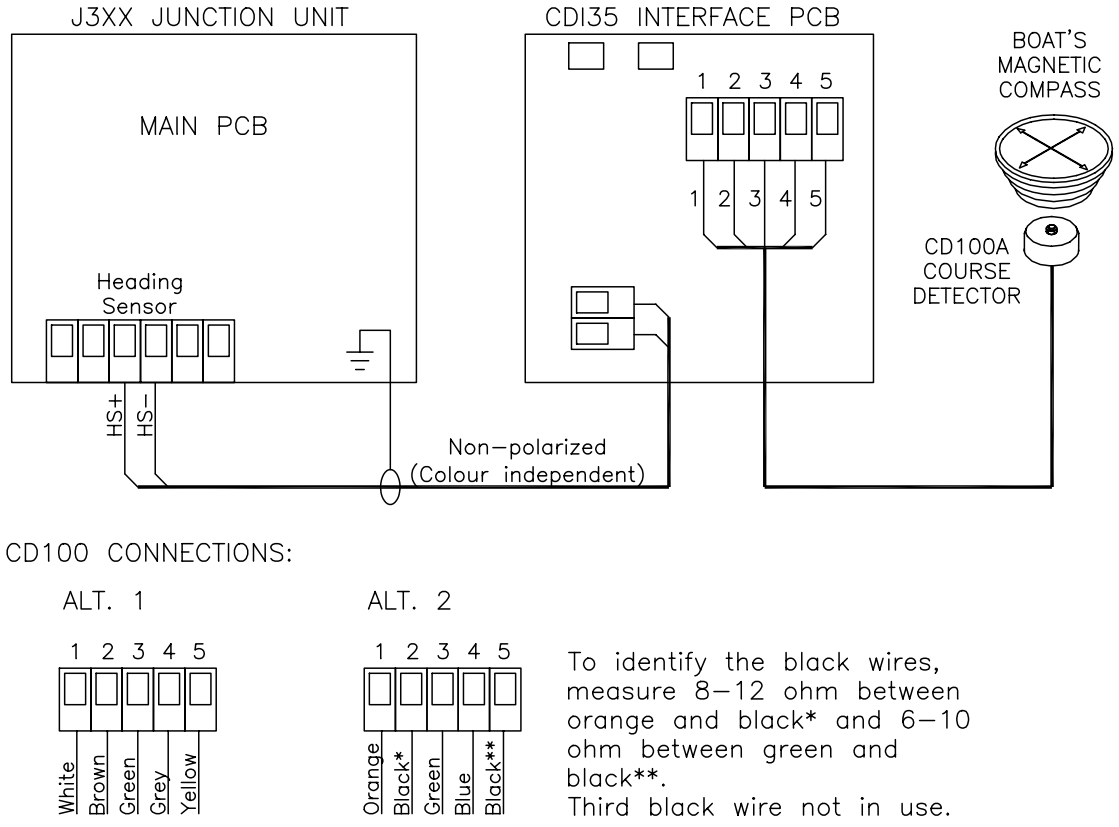


Figure 4-29 CDI35 connections

Note ! *CD100 has a connector that has to be cut off the cable.*

4.30 Software Setup Procedure

Description of Installation Settings

The design of the AP20 includes advanced features that have simplified the installation and setup of an autopilot. The principle advantage is that manual adjustments that needed to be done on previous models are no longer necessary with the AP20.

Note ! *The installation settings must be performed as part of the installation of the AP20 system. Failure to correctly set the values in the installation settings may prohibit the AP20 from functioning properly!*

The Installation Settings are grouped into the following functional categories:

- Language: Selects language used for display information
- Dockside Settings: Items to be set prior to seatrials
- Interface Setup: Sets the identification of navigation and optional equipment connected to the AP20 system
- Seatrial Settings: Determines automatic calibrations and steering parameters
- Parameters Permits viewing, setting or changing of steering parameters
- NMEA test Loopback test menu to verify that the hardware is OK.
- Display Units Conversion of units.
- Master reset Master reset of memories.

Each group is designed to focus on specific functions related to an installation activity, and enable quick access when changes need to be made.

Some important points regarding the installation settings values:

- When the AP20 is delivered new from the factory, (AND ANY TIME AFTER A MASTER RESET OF MEMORIES HAS BEEN PERFORMED) the Installation Settings are all reset to preset (default) values. The warning message "INSTALLATION SETUP REQUIRED" will appear at turn

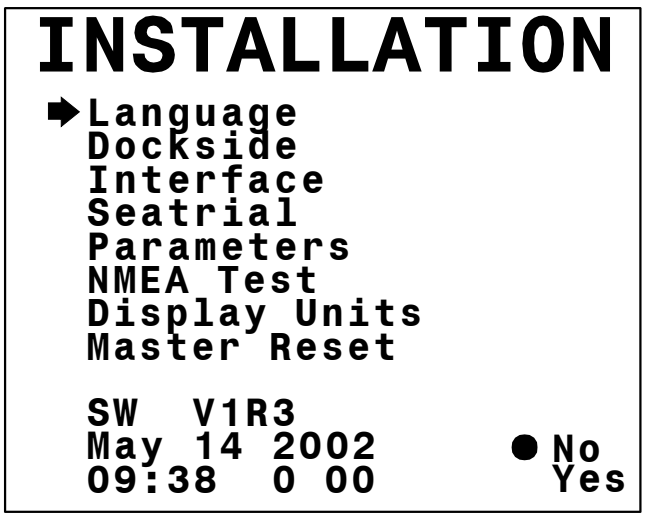
on and if an attempt is made to access the AUTO or NAV modes prior to completion of setup.

- The Dockside, Interface and Seatrial settings can only be accessed when the system is in STBY mode.
- The values that are selected (also referred to as "PARAMETERS") from within the Installation Settings Menu, are stored in the memory of the AP20 system. No specific action is required to "SAVE" the selected values. Once the value is changed, it is stored until the next time the menu item is selected and changed.
- The Installation Settings are considered global, enabling values to be available to all control units in the system.
- The values in the Seatrial Settings are dependent on successful completion of the Dockside Settings.

Before attempting to turn on the AP20 and perform an Installation Setup, the hardware installation and electrical installation must be completed in accordance with the installation instructions.

Installation Menu

The Installation Menu (IM) is presented on the autopilot display by pressing and holding the NAV/SETUP push-button for 5 seconds.



Note ! *The INSTALLATION MENU is different from the USER SETUP MENU . Refer to flow diagram on the next page for a pictorial view of the Installation Menu.*

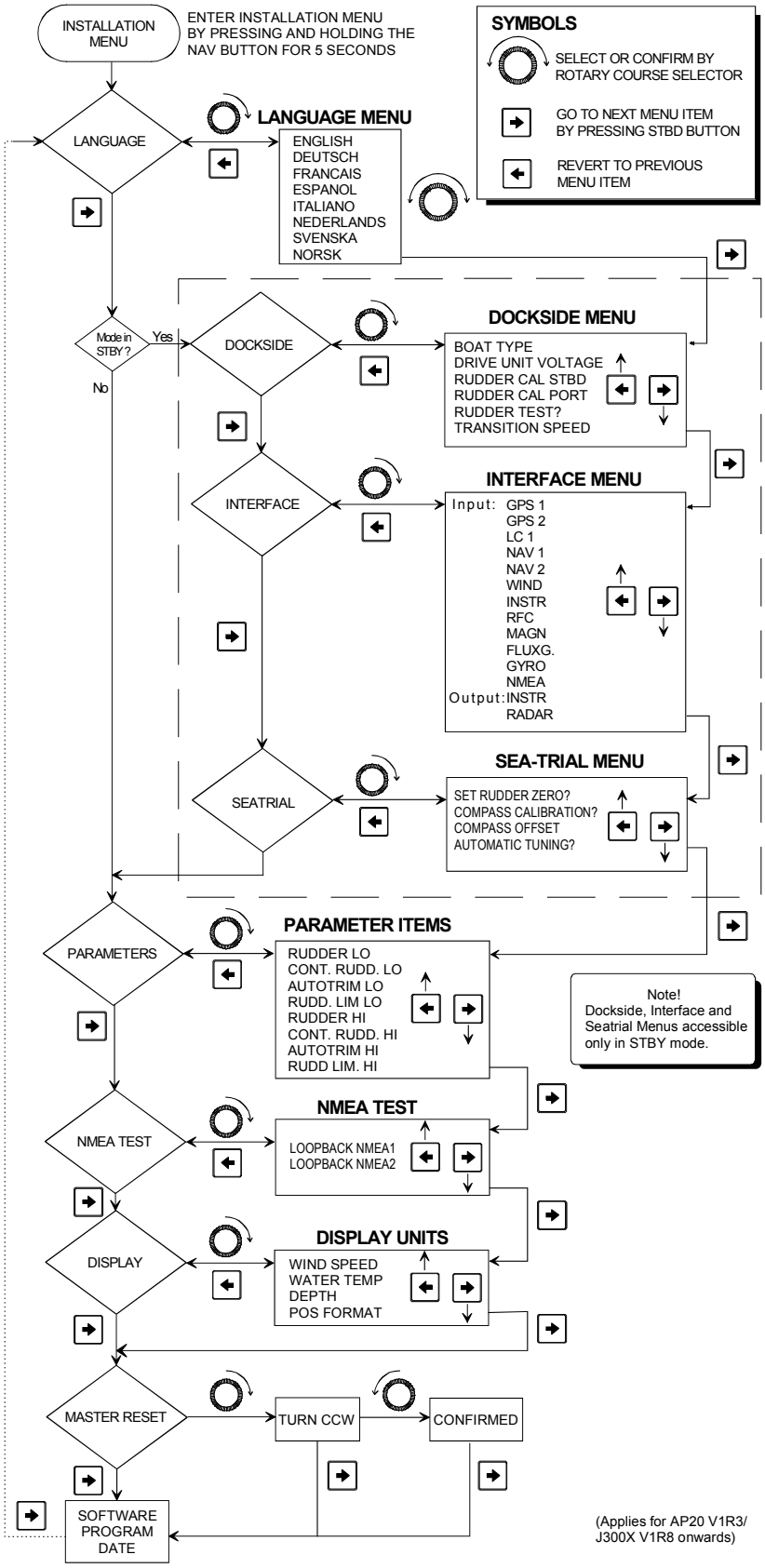


Figure 4-30 Installation Menu Flow Chart

There are several actions that you can do once you have accessed the IM:

- Answer YES to the question by rotating the course knob clockwise.
- Change the selected item shown by rotating the course knob.
- Proceed to the next item in the menu by pressing the STBD push-button. (Proceeding to the next item when presented with a question is the same as answering NO to the question.)
- Proceed back to the previous item in the menu by pressing the PORT button.
- Leave the IM by selecting STBY, AUTO, or NAV.

On new installations, and whenever a control unit, junction unit, or software is replaced in an AP20 system, it is recommended that a MASTER RESET be performed as described in the IM prior to proceeding with the setup procedure.

When using the ISM refer to diagram "Installation settings Menu Flow Chart" on previous page.

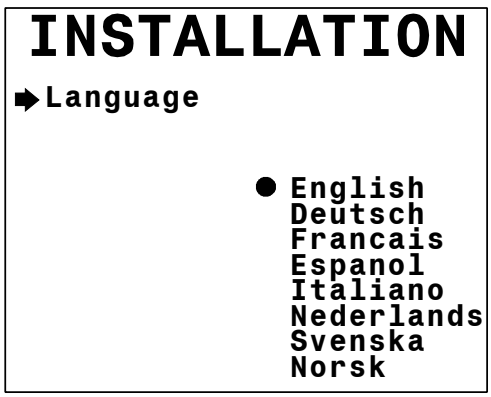
Language selection

The AP20 can present the display in eight different languages:

- English, Deutsch, Francais, Espanol, Italiano, Nederlands, Svenska and Norsk.

To access the language selection in the IM:

1. Select Language by using the STBD / PORT buttons
2. Answer yes by turning the course knob.
3. Turn the course knob to select the language you wish to use.
4. Leave the IM by a press on the STBY button, or continue to next item in the IM by pressing STBD button.



4.31 Dockside settings

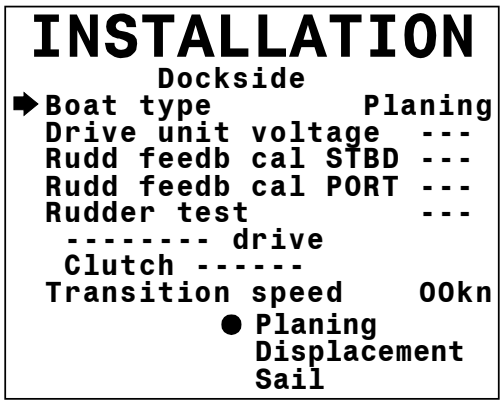
The following menu items are accessible and can be set up in the Dockside Menu:

- Boat type
- Drive Unit voltage
- Rudder Feedback calibration
- Automatic Rudder test
- Transition Speed

In addition the Dockside Menu display will show:

- Drive output
- Clutch/bypass verification

Select STBY mode and enter the IM as previously described. Select "Dockside" by pressing STBD [>] button and confirm by rotating the course knob.



Actual boat type is selected by turning the rotary course knob. The options are: Displacement, Planing, Sail.

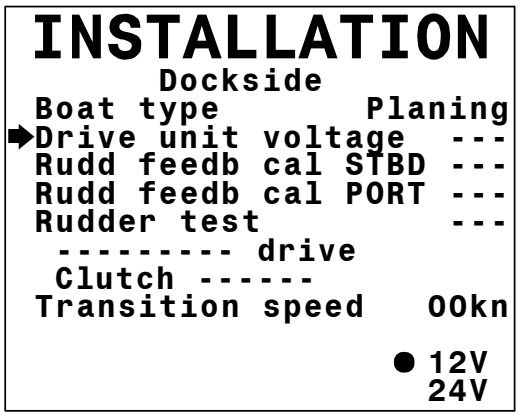
Type of boat will affect the steering parameters, and the functions available in the autopilot system. Select appropriate boat type and press STBD [>] button.

Drive unit voltage selection

This menu option requires the installer to set the drive unit voltage to the correct level. The selections are 12V or 24V and should be set to the voltage specified for your drive unit.

Note ! *Selection of improper voltage level for your drive unit may damage both the drive unit and junction unit even if the protection circuits in the junction unit are activated.*

Refer to the drive unit table on page 58 for information. It is not possible to select a higher voltage than the input voltage. The CLUTCH/BYPASS voltage is automatically set to the same as the drive unit voltage. In Rudder Test, the AP20 system will automatically detect whether the drive unit is a reversible motor or solenoid operated.



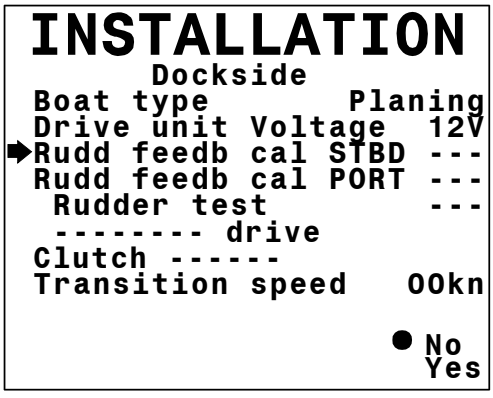
To change the voltage selection, rotate the course knob.

Note ! *The drive unit voltage setting does not apply when operating solenoids on a continuous running pump/steering gear. Hence, the output voltage to the solenoids will be the same as the input voltage.*

Proceed to next menu item by pressing STBD [>] button.

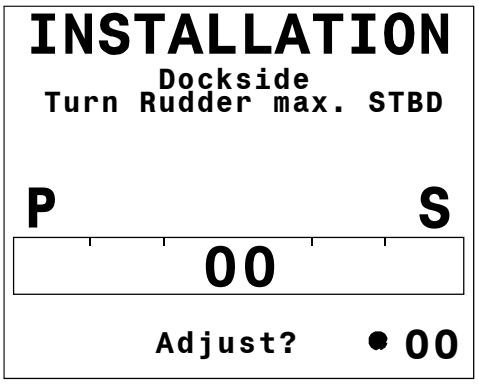
Rudder Feedback Calibration

Make sure the RF300 is installed and aligned as pr. instruction in section 4.6 (or eventually section 4.27 for LF3000). This function enables you to compensate for any non-linearity in the transmission between the rudder and the rudder feedback.

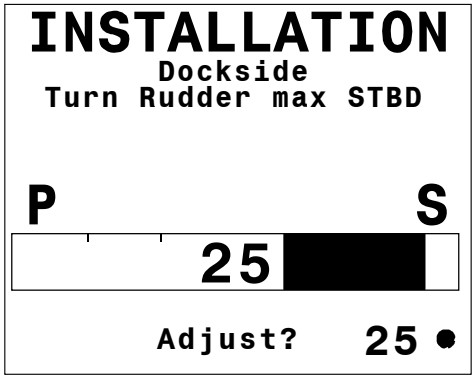


Confirm by rotating the course knob clockwise.

The display will show with the rudder in mid position:



Manually turn the helm to starboard until the rudder stops at maximum starboard rudder.



The value shown on the display is the value read by the rudder feedback unit before any adjustment is made. If the actual rudder angle is different from that of the display, correct the reading on the display by turning the course knob clockwise to increase the value or counter clockwise to decrease the value.

Note ! *If the rudder feedback unit is mounted upside down, the displayed rudder angle will be to the opposite side before you start the adjustment.*

Advance to the next step by pressing the STBD [>] button.

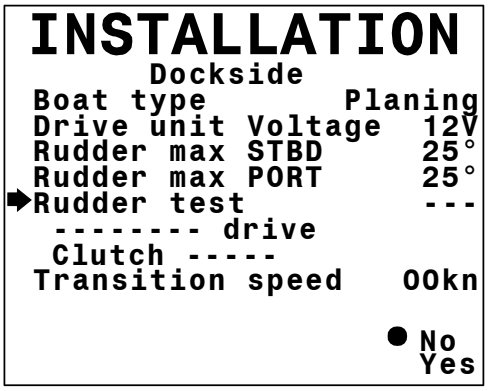
Manually turn the helm wheel to port until the rudder stops at maximum port rudder.

Note ! *If you are not making any adjustment to the display readout (i.e. not turning the course knob), the AP20 will set a (default) value of 45° to each side in order to get full deflection on the display. If the real rudder deflection is less than ±20°, make sure the Rudder Limit (which default is 20°) is set 2°-3° less to avoid the rudder hit the end stops.*

Adjust the displayed angle the same way as for starboard adjustment. (This time you need not correct for wrong side if the rudder feedback unit is upside down).

Note ! *Rudder zero may still not be accurate but will be adjusted later during sea trial.*

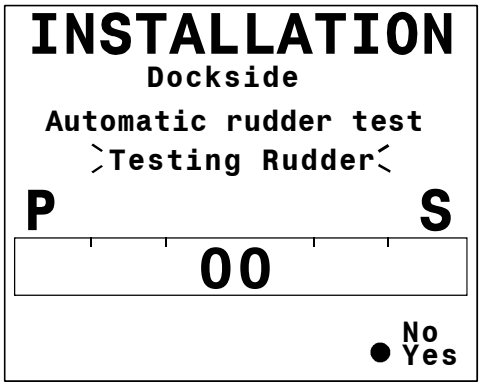
Proceed to next menu item by pressing STBD [>] button.



Automatic Rudder Test

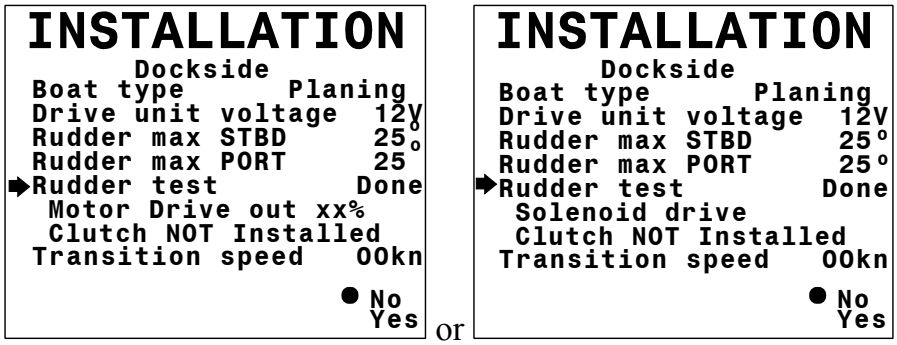
Note ! *Bring the rudder manually to midship position before starting the test. It is important also that if the boat uses power assisted steering, that the engine or electric motor used to enable the power assist steering be turned on prior to this test.* ***Stand CLEAR of the wheel and do not attempt to take manual control of the wheel during this test!***

Activate the automatic rudder test by turning the course knob clockwise.



The AP20 will after a couple of seconds issue a series of PORT and STBD rudder commands and automatically verify correct motor direction, and reduce the rudder speed if it exceeds the maximum acceptable speed for autopilot operation.

When test is finished the display will read:



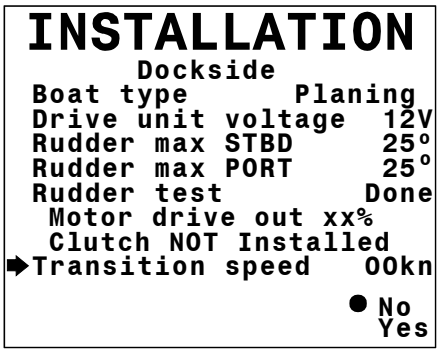
If the drive unit has a clutch or bypass, "NOT" will be excluded.

Test of LF3000/LFI3000 Mk2 feedback

1. *Align engines to centre position; "zero rudder".*
2. *Rev engines to 3-4000 rev/min and observe the rudder angle indicator on the autopilot, a 2° change in the reading should be accepted.*
3. *If the rudder angle exceeds 2°, connect the screen on the TB1 cable to the centre block terminal and repeat item 2 (See* Figure 4-27*). If this gives a better result keep the screen connected.*

Proceed to next menu item by pressing STBD [>] button.

Transition Speed



The transition speed is the speed where the AP20 will automatically change the steering parameter set from HI speed to LO speed parameters, or vice versa.

The default setting of transition speed is zero, which requires that steering parameter selection be done manually. If a GPS, Loran, or external speed log input (from IS15 or other instrument systems) is connected the transition speed must be set to a value greater than 0, to enable the automatic speed selection feature in the AP20.

It is recommended that you set the transition speed to a speed that represents the speed where the hull begins to plane, or where you would manually change the parameters from HI to LO.

The speed used for the automatic transition is obtained as follows:

1. Data from the source set for the INSTR channel in the interface setup. If this is a valid source of VHW (speed through the water) data, then this data is used to change the HI-LO parameter sets.
2. If VHW data is not available from the INSTR channel or if the INSTR channel is not selected as source, the AP20 system will use the speed data obtained from the VTG (speed over ground) sentence received from the currently selected POS source.

If no speed data is available, manual speed selection is required. The AP20 will always default to the HI speed steering parameters when the system is first turned on, or if there is a speed data failure.

If manual speed selection is used, the manual setting will override the automatic until the AUTO mode is re-selected.

Rotate the course dial clockwise until the transition speed is set to the desired value in knots.

Proceed to next menu item by pressing STBD [>] button.

Interface Settings

The AP20 system provides a totally flexible approach to the input of data from heading sensors and other peripheral equipment. Identification of the type of equipment connected to the AP20 system is performed in the Interface Menu.

To be able to display all information on the instrument screens (paragraph 2.22) refer to the table in paragraph 3.1 for required NMEA messages.

When your system includes connection of external equipment to the NMEA0183 data ports in Junction Unit or NI300X, or if the CI300X is installed with optional compass units or an optional analogue wind vane unit, they must be configured under the Interface Menu. This procedure allows you to assign an abbreviated name to identify the type of equipment that is connected to each of the available hardware ports in the AP20 system.

Abbreviated name	Equipment / Usage	NOTES
GPS1	Primary GPS	Can be used as either NAV source or POS source. Also for VTG data for automatic AUTO HI/LO speed selection
GPS2	Backup GPS	
LC 1	Loran	
NAV1	Chart plotter	
NAV2	Other Nav source.	
INSTR	Source of data for instrument screens and automatic HI/LO parameter selection	Log input (VHW) for speed data has priority to SOG from GPS navigator.
RFC	For use when selecting between Simrad fluxgate compasses	RFC35 fluxgate compass is connected to junction unit. RFC35R rate compass is connected to Robnet
MAGN	Magnetic compass with course detector (CD100A)	CDI35 +CD100A is connected to junction unit. CD100A only must be connected to CI300X.
FLUXG	For use with non-Simrad fluxgate compasses that output SIN/COS	Optional CI300X item.
GYRO	For use with Simrad RGC50, RGC10 gyro (1:1 synchro output)	Optional CI300X item. True data displayed for heading, COG and bearing to waypoint
NMEA (Applies for AP20 V1R3/J300X V1R8 onwards)	For use with NMEA compasses	Gyro, THD or other
Output INSTR	For high speed NMEA output of compass heading	HDM or HDT output increased from 1 to 5 times/sec. on TX1 port
Output RADAR	Clock/data heading output to radars	Selectable between Anritsu and Furuno (on both J300X and NI300X)

Note ! *If using J300X, TX2 outputs HDT or HDG at 10 Hz.*

Interface setup - input signal

Setup item (abbrev. name)	Equipment connected	Hardware port terminal (use one available from list)	Hardware port to be assigned (* = default setting)
GPS1		Not connected	– – – –
		J3XX, Main PCB NMEA I/P RX1+,RX1–	J300X-1 * (on J3000X)
		J300X, Power PCB NMEA I/P RX2+,RX2–	J300X-2 * (on J300X and J300X-40)
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
GPS2		Not connected	– – – – *
		J300X, Main PCB NMEA I/P RX1+,RX1–	J300X-1
		J300X, Power PCB NMEA I/P RX2+,RX2–	J300X-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
LC1		Not connected	– – – – *
		J3XX, Main PCB NMEA I/P RX1+,RX1–	J300X-1
		J300X, Power PCB NMEA I/P RX2+,RX2–	J300X-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
NAV1		Not connected	– – – –*
		J3XX, Main PCB NMEA I/P RX1+,RX1–	J300X-1
		J300X, Power PCB NMEA I/P RX2+,RX2–	J300X-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
NAV2		Not connected	– – – –*
		J300X, Main PCB NMEA I/P RX1+,RX1–	J300X-1
		J300X, Power PCB NMEA I/P RX2+,RX2–	J300X-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4

J3XX = All junction unit models
J300X also includes J300X-40

Setup item (abbrev. name)	Equipment connected	Hardware port terminal (use one available from list)	Hardware port to be assigned (* = default setting)
INSTR		Not connected	– – – –
WIND		J3XX, Main PCB NMEA I/P RX1+,RX1–	J300X-1*
		J300X, Power PCB NMEA I/P RX2+,RX2–	J300X-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
RFC		Not connected	– – – –
	RFC35	Junction unit: HS+, HS–	J300X
	RFC35R	Connection to ROBNET	ROBNET * (V1R3/V1R8 onwards)
MAGN		Not connected	– – – –*
	CDI35+CD100A	Junction unit: HS+, HS–	J300X
	CD100A	CI300X Magn. Comp. terminal	CI300X
FLUXG		Not connected	– – – –*
		CI300X Analogue terminal	CI300X
GYRO		Not connected	– – – –*
	RGC50, RGC10	CI300X Gyro terminal	CI300X
NMEA	NMEA compass	J300X, Power PCB, NMEA I/P RX2+, RX2–	J300X-2

J3XX = All junction unit models

Interface setup - Output signal

Setup item	Output signal	Output terminal	Select output (* = default setting)
Output INSTR	NMEA output of compass heading	Junction unit Main PCB, NMEA, TX1+, TX1–	J300X-1 * 5x/second – 1x/second
Output RADAR	Clock/data heading output to radars	J300X Power PCB, TB9	Anritsu * Furuno

Note 1 *The standard NMEA output rate is 1x/second. When Output INSTR is set to J300X-1 (default), the output port, TX1, will have an output rate of 5x/sec. for HDG or HDT (heading) messages. The RSA (rudder angle) message is always 5x/sec.*

Note 2 *NMEA OUTPUT 2 on J300X has a constant output rate of 10x/sec. for HDG or HDT. Both port 1 and 2 are still sending HDM at 1 Hz. HDM is an obsolete sentence but some older equipment may still use it.*

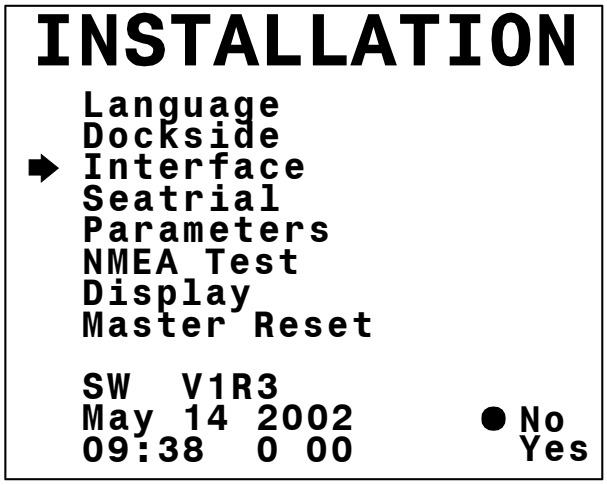
The Interface Menu presents these names so that they can be assigned to a hardware input or output port. Each abbreviated name is then presented in appropriate locations of the USER

SETUP MENU to provide the user with choices of data sources, or identified to the AP20 where to look for various types of data.

When you assign a hardware port to an abbreviated name, you are simply telling the AP20 system that when the user chooses an abbreviated name as a data source it should look to the hardware port assigned to the abbreviated name for data.

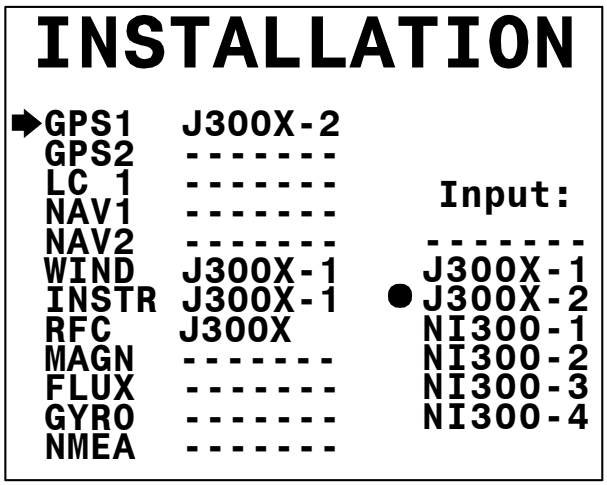
- Step to the Interface part of the Installation Menu.

The following display will be presented:



To access the Interface Setup items, turn the course knob clockwise.

The display will show:

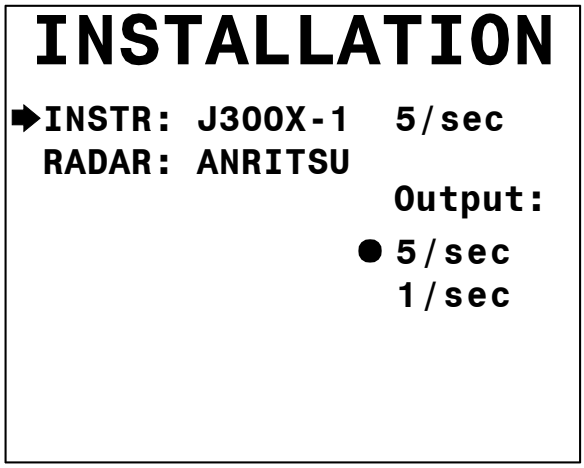


Abbreviated name	Assigned HW port	HW ports that can be assigned

Assign a hardware port to the name by turning the course knob until the hardware port is displayed along with the name.

Proceed to the names on the list that shall be assigned by pressing STBD [>] button. Select appropriate hardware ports by turning the course knob, or exit from menu by stepping through the list of names by pushing STBD [>] button.

Note ! *At the completion of the Interface Setup, the names of items that you have assigned hardware ports to will be available as sources of data for NAV (navigation), POS (position) and COMPASS in the USER SETUP MENU. It is recommended that you access the User Setup Menu directly after completing the Interface Setup to select the desired data. Refer to page 31 for details on changing the items in the User Setup Menu.*



Abbreviated name	Assigned HW port	NMEA output rate

Note ! *The standard NMEA output rate is 1x/second. When Output INSTR is set to J300X-1 (default), the output port, TX1, will have an output rate of 5x/sec. for HDM or HDT (heading) messages. The output rate may be changed to 1x/second by rotating the course knob. The RSA (rudder angle) message is always 5x/sec.*

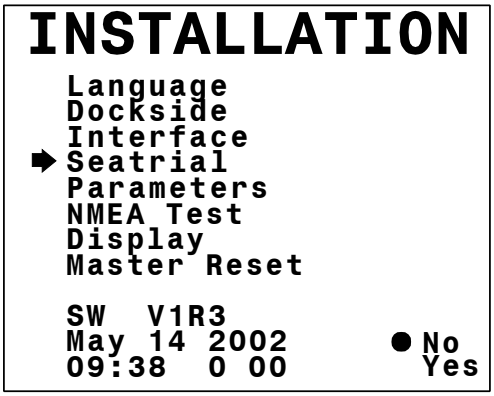
4.32 Sea Trial

The Sea-trial menu can only be accessed if the Dockside Settings are done and confirmed. It is also recommended that the Interface Setup be performed prior to Seatrial settings.

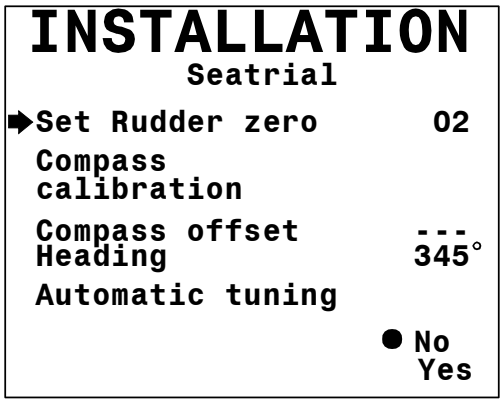
The seatrial settings do the following:

- Rudder zero adjust (To tell the AP20 the precise midships position of the rudder)
- Compass calibration (To automatically compensate for onboard magnetic Deviation)
- Compass Offset (To offset the final compass heading readout)
- Automatic tuning (An optional method of determining the steering parameters)

Advance through the IM until the following display is presented:



Confirm by rotating the course dial Clockwise.

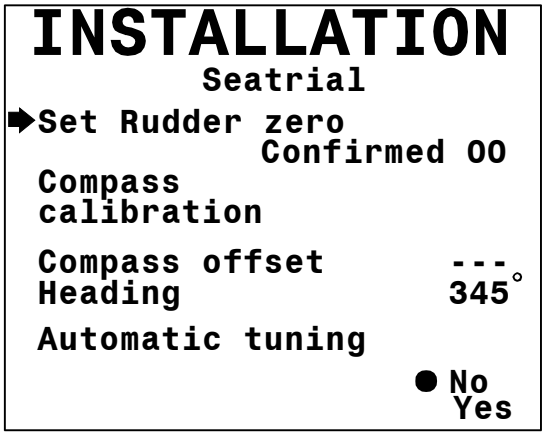


Rudder zero adjust

The adjustment should be made in calm sea and side forces from wind or current should be avoided.

- Bring the boat up to cruising speed, and head directly into the wind.
- If the boat has twin engines, synchronize the engine RPM's.
- Set the trim tabs and stabilizers to have no effect on the boats heading.
- Steer the boat manually on a steady course.
- Confirm the rudder ZERO position by rotating the course knob clockwise.

The display will then show:



Press STBD [>] to proceed to next menu item.

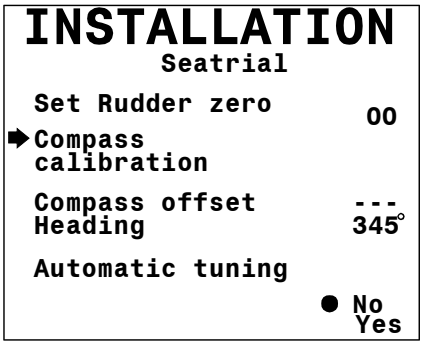
Compass calibration

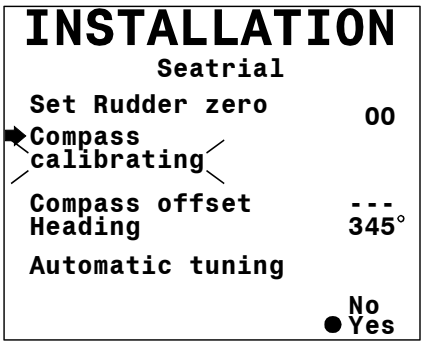
This function will activate the automatic compass calibration procedure.

Note ! *If an optional magnetic compass is installed and connected to a CI300X, or if a GYRO compass, or other manufacturers fluxgate is connected to a CI300X, it is still required to perform the automatic compass calibration in order to calibrate the CI300X Interface/input signal.*

Before you begin the compass calibration procedure, make sure you have enough open water around you to make a full clockwise turn with the boat.

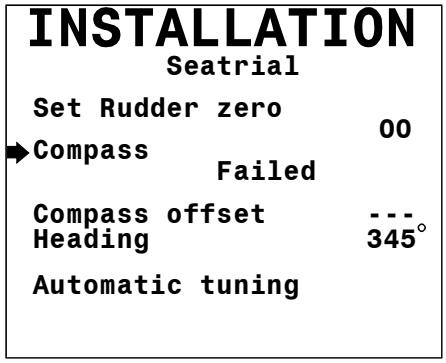
The calibration should be done in calm sea conditions and with minimal wind to obtain good results. Use about 45-60 seconds to make a full circle.





1. Begin turning the boat to starboard (can also turn to port).
2. Start compass calibration by turning the course knob clockwise. The display will flash “calibrating”.
3. When the calibration is completed, (after having completed approximately 1 1/4 turns), it will be confirmed by the display reading “confirmed”.

If the compass is close to disturbing magnetic objects, the compass calibration may fail, and the display will show:



In that case move the compass to a better location and re-calibrate.

After calibration, check the compass readout against a known reference, other compass or leading line. If the reading is correct (+/-3°) except for a fixed offset, proceed to next menu item by pressing STBD [>] button.

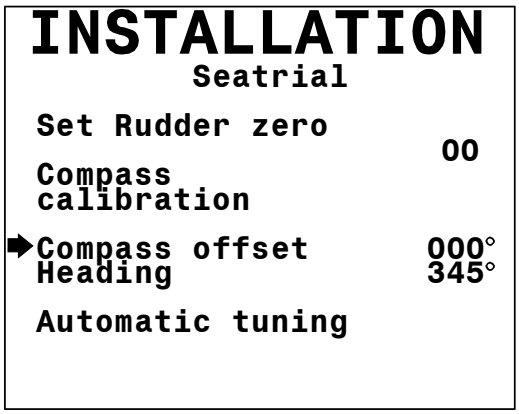
Compass Offset

Note ! *Offset correction is always performed after the calibration.*

The compass OFFSET feature allows you to correct for a constant compass heading offset that may be present as a result of the compass being installed with a lubber line offset or a fixed offset remains after the calibration procedure has been completed. The value of compass offset is specific to the heading sensor that is selected at the time the offset is entered.

(For multiple heading sensor offset procedure, refer to separate CI300X manual).

The following display is presented when accessing the COMPASS OFFSET screen:



Dial in the correction by turning the course knob to offset the compass heading to agree with a known heading or bearing. The offset value can be either positive or negative.

Note ! *If an OFFSET still exists after having accounted for the mechanical offset, one of the following problems may still exist:*

- The heading reference that you are comparing the compass is not accurate.
- The automatic calibration obtained by the compass is not correct, and may be due to a large magnetic influence near the compass (a relocation may be needed) or too much waves during calibration.

Proceed to the AUTOTUNE function by pressing the STBD [>] button, or return to STBY mode.

Automatic tuning

AUTOTUNE is a dynamic function that enables the AP20 system to automatically set up the two main steering parameters (Rudder, Counter Rudder) for the boat. The scaling factors of the parameters are also set automatically as a function of the boat type selection performed in the Dockside menu.

Note ! *Autotune is an optional procedure that is not required for the AP20 to function. The AP20 is preset with steering parameters that should steer most boats in the 30 - 80 foot range and Autotune is not needed if the preset parameters steer your boat satisfactory.*

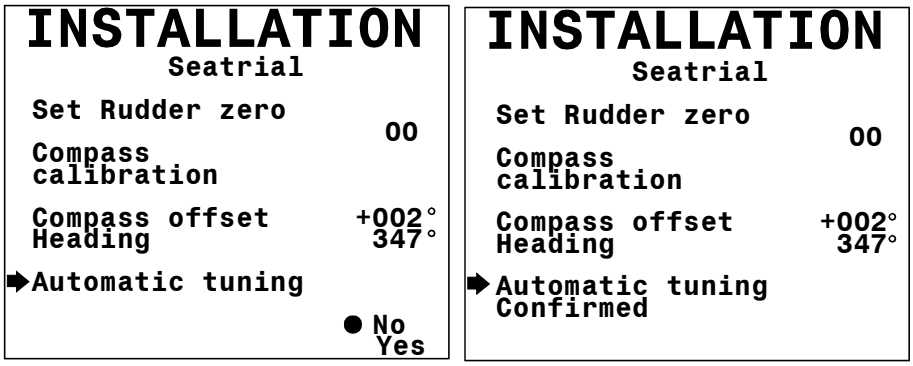
Recommended speed during Autotune varies with the type of boat, but should not exceed 10 knots. Autotune should not be performed at planing speed!

For displacement boats use a speed that is approximately half the normal cruising speed (i.e. if cruising speed is 10 knots, do the Autotune at about 5 knots).

The parameter values calculated during Autotune becomes the LO speed parameters. The HI speed parameters are automatically set to 66% of the LO.

If possible it is recommended to perform the Autotune steering East or West, as this will yield the best balanced parameters.

WARNING ! **The Autotune function will take control of the boat and perform a number of S-turns. It must always be performed in open waters with sufficient safe distance to other traffic. The Autotune function may take from 1 to 2 minutes to complete.**



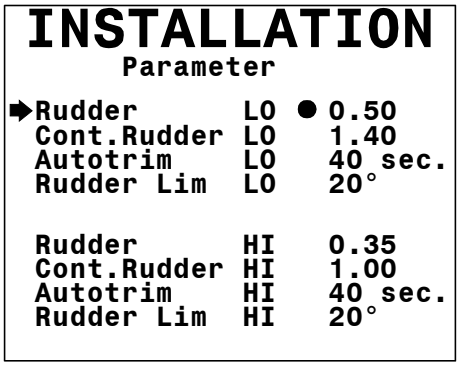
Activate the AUTOTUNE, by rotating the course knob clockwise. The display will flash “Automatic tuning”.

After the Autotune has been completed the rudder must be controlled manually, as the mode is returned to STBY.

When the Autotune has been completed, there should normally be no need for further adjustments. On certain installations, however, you may want to "fine tune" the parameters after the Autotune due to the special steering characteristic of a specific boat. Viewing or changing the Autotune parameters are done from within the VIEW PARAMETERS menu item.

Exit the Seatrial menu by pushing STBD [>] button to proceed to the Parameters menu, or press STBY to return to normal AP20 operation.

View parameters

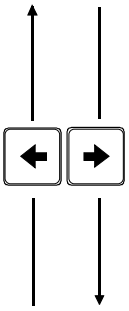


A boats steering parameters found by Autotune can be looked at and if needed changed under this menu item. The steering parameters can also be set manually instead of performing an Autotune. The parameters are divided into two sets:

- HI = Steering parameters for automatic steering at HI speed
- LO = Steering parameters for automatic steering at LO speed

Manual parameter adjust

Use course knob to adjust parameters



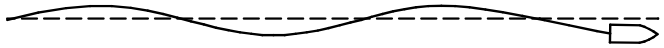
Use PORT and STBD buttons to step through parameters.

Displayed parameter	Boat type:		Own boat	
	Displacement & Sail	Planing	Autotune	Manual
LOw speed				
Rudder LO	0.50	0.30		
Cont Rudder LO	1.40	1.40		
Autotrim LO	40 sec.	40 sec.		
Rudder lim LO	20°	20°		
HIgh speed				
Rudder HI	0.35	0.20		
Cont Rudder HI	1.00	1.00		
Autotrim HI	40 sec.	40 sec.		
Rudder lim HI	20°	20°		

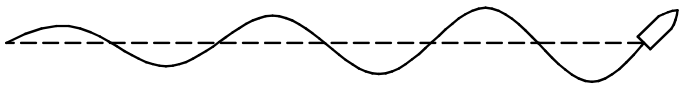
Note ! *The values in the table are factory set (default) and listed for information only. After having performed the Autotune, the values may differ from those listed in the table. It is recommended that you write down the parameters "learned" by the Autotune prior to making any adjustments.*

The two most important parameters that determine the performance of the automatic steering are Rudder and Counter Rudder.

Rudder sets the rudder gain which is the ratio between the commanded angle and the heading error (P-factor).



Too little rudder

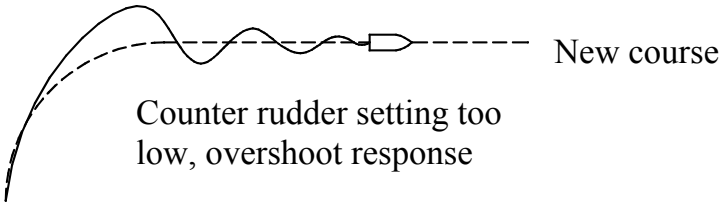


Too much rudder

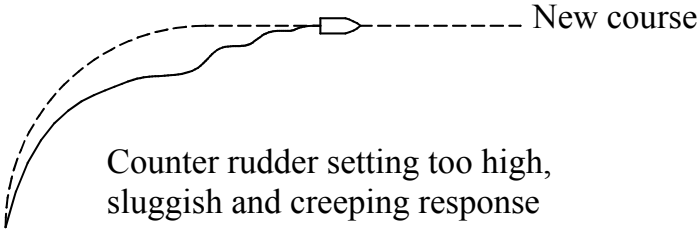
- Too little Rudder and the autopilot fails to keep a steady course.
- Too much Rudder gives unstable steering and reduces speed.
- Low speed requires more rudder than high speed.

Counter Rudder is the parameter that counteracts the effect of the boats turn rate and inertia. For a short time period it is superimposed on the normal rudder response as provided by the Rudder parameter. It may sometimes appear as if it tends to make the rudder move to the wrong side (counter rudder).

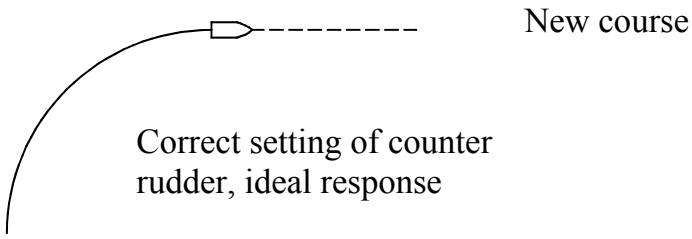
The best way of checking the value of the Counter Rudder setting is when making turns. The figures illustrates the effects off various Counter Rudder settings.



Counter rudder setting too low, overshoot response



Counter rudder setting too high, sluggish and creeping response



Autotrim standard value is 40 sec. which should work well on most boats.

Rudder Limit should be kept at 20 degrees unless there is a need for more rudder when performing dockside manoeuvres.

Caution ! ***In no event should the Rudder Limit be set to a value higher than the actual maximum rudder angle.***

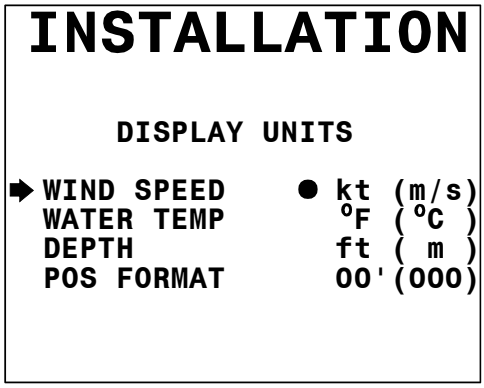
Exit the Parameter menu by pressing STBD [>] button to proceed to the Display Units menu, or press STBY to return to normal AP20 operation.

NMEA Test

This menu item is for trouble shooting only. Do not pay attention to the readings on the display if the system interface is OK.

Proceed to the Display Units menu by pressing the STBD [>] button, or press STBY to return to normal AP20 operation.

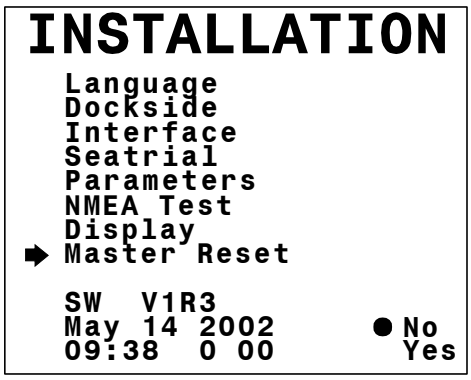
Display Units



Use STBD button to select item and course knob to select the appropriate unit.

Exit the Display Units menu by pressing STBD [>] button to proceed to the Master Reset menu, or press STBY to return to normal AP20 operation.

Master Reset



Note ! *A Master Reset is part of the final test at factory and will reset the memories to factory settings. Unless you need to clear all stored values during the installation setup procedure, you should not perform a Master Reset. Master reset will also clear compass calibration values stored, except for RFC35R Rate compass where values are stored in the compass.*

The Master Reset needs a double confirmation to prevent an unwanted reset. To perform a Master Reset, rotate the course knob clockwise and observe the display; then rotate the course knob counter clockwise.

Exit the Installation Menu by pressing STBY to return to normal AP20 operation.

Final sea trial

After having completed all settings in the Installation Menu, take the boat out and perform a final sea trial in open waters with sufficient distance to other traffic.

- Steer the boat on all cardinal headings in AUTO mode.
- Start with low and medium speeds to get familiar with the response from the AP20.
- Try the effect of LO and HI speed settings.
- If the hardware for automatic HI/LO speed selection is connected and configured, verify that the HI/LO transition is occurring, and the HI/LO parameters are changing after the

transition speed is crossed (by more than 1 Knot higher or lower speed).

- Try the Dodge function and the U-turn.
- If a Non-Follow Up lever (or handheld remote) is connected, test the mode switching and verify Port and Stbd steering commands of the lever.
- Set waypoints into each navigator connected to the system, and verify that the AP20 steers in NAV mode for each NAV source.
- If the boat is a sailboat use the WIND mode and try the AP20 at different settings of the apparent wind angle.
- Provide the owner with user training.

Providing user training

The user should be instructed in the "basic" operational functions, such as:

- Turning the system on and off
- Explain how to change modes (explain briefly what takes place in the different modes).
- Regaining manual control from any mode. Point out in what modes the helm is engaged by the autopilot (bypass/clutch).
- How to take command at an "inactive" station if applicable.
- Lock mode and how to lock/unlock and how to shut the system down from a locked control unit if applicable.
- Show NFU and FU steering and explain the difference.
- Review how to use a NFU controller if connected.
- Course change by rotary knob and buttons.
- Go through the user SETUP menu and show how to (and why) change the settings.
- Also include Nav. source, Pos. source and Compass sensor selection if applicable.
- Show the owner where the compass (or compasses) is mounted and instruct him to keep magnetic items away.
- Show where the Mains circuit breaker is.

5 MAINTENANCE

5.1 Control unit

The AP20 Control Unit will under normal use require little maintenance.

If the unit requires any form of cleaning, use fresh water and a mild soap solution (not a detergent). It is important to avoid using chemical cleaners and hydrocarbons such as diesel, petrol etc.

Make sure that all open ROBNET connectors are fitted with a protection cap.

It is advisable at the start of each season to check all connections to the control unit head and cover with Vaseline or WD40. If the Control unit is not removed from the boat, it should be covered with the white protection cover.

5.2 Junction Unit

No special maintenance is required. It is advisable, however, at the start of each season to make a visual inspection of the internal and check all connections.

5.3 Rudder Feedback

Make a visual inspection at 2-3 month intervals and at the start of each season. Apply some grease at the ball joints when required (RF300)

5.4 Compass

If the compass is exposed to the weather, make a visual inspection at 2-3 months intervals, and at the start of each season.

5.5 Drive unit

Refer to the drive unit manual for maintenance instructions.

5.6 Exchange of software programme

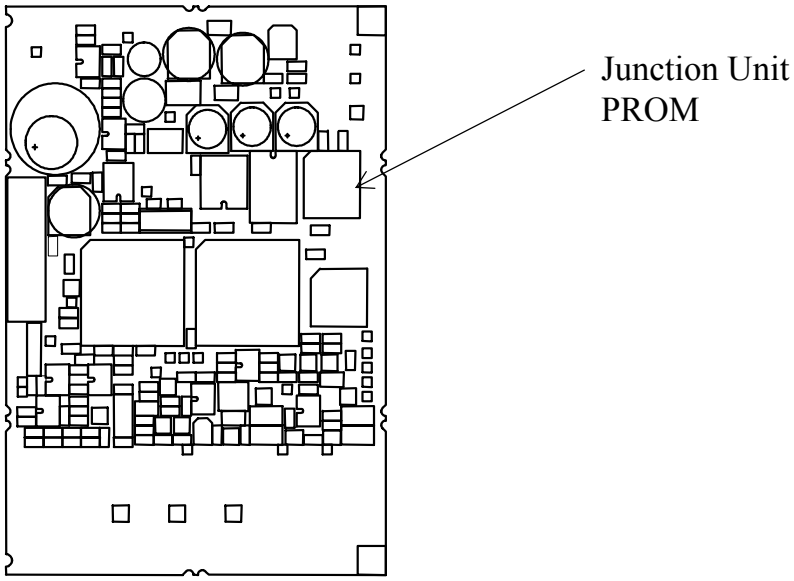


Figure 5-1 J3000X/J300X/J300X-40 Main PC-Board

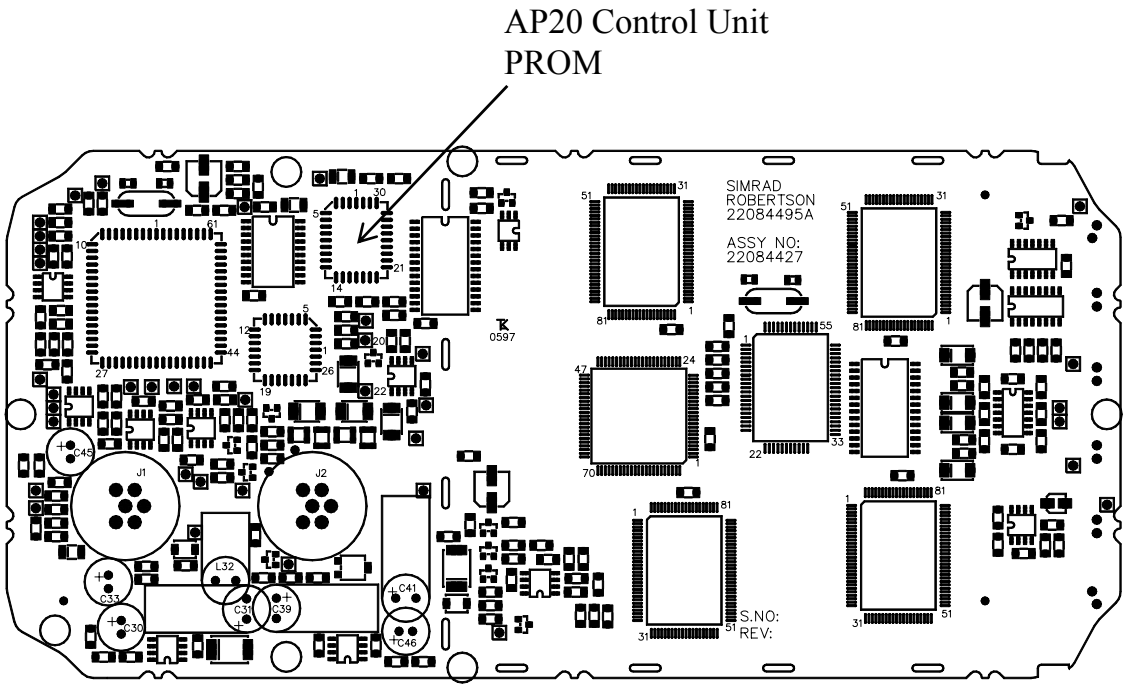
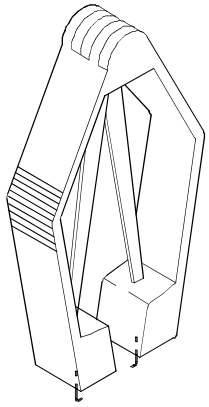
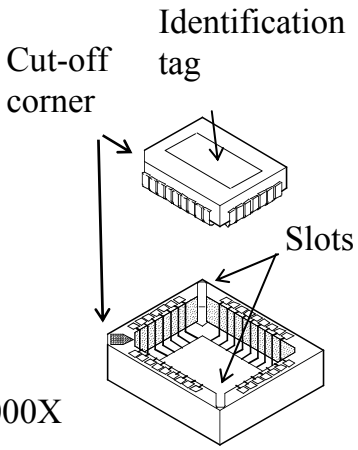


Figure 5-2 AP20 PCB, component layout

- Remove the PROM from the socket by means of the special extraction tool (p/n 44139806).
- Insert the tool by pressing the two grip pins down into the two slots in the corners of the socket.
- Squeeze the tool and pull out the PROM.
- When inserting new PROMS, make sure the cut-off corner matches with the one in the socket. Press it gently into the socket.



- The identification tag indicates:
  - Name of unit
  - Part number
  - Software version



WARNING ! Make sure that the right PROM is mounted in the actual unit.

PROM for AP20 Control Unit:
P/N 22084834

PROM for J300X, J300X-40 and J3000X Junction units: P/N 22081640

- After change of PROM, perform a master reset as described on page 104.

6 TROUBLE SHOOTING

An autopilot is a complex system and the performance is dependent of a proper installation and a successful sea trial.

In the event of a failure, you will be helped by the AP20 software which contains several test features that will assist you in isolating a probable fault.

Audible and visual alarms are given in the event a fault is detected.

The audible alarm is reset by pressing any button (e.g. by changing mode from AUTO to STBY). The visual alarm will remain and alternate with the operating display until the fault has been rectified. Refer to the table below for hints and try to solve the problem yourself, or consult your nearest Simrad dealer for assistance.

Perform the repair action in the listed order.

6.1 Alarms

Display readout	Probable fault	Recommended action
System failure Alarms:		
Rudder feedback failure (autopilot operates on simulated feedback)	Rudder feedback signal missing or erratic	1. Check all connections. 2. Check the alignment as per the installation instructions 3. Replace rudder feedback unit.
Rudder response failure	No response to rudder command.	1. Check all connections 2. Check Rudder FB transm. link. 3. Check Drive unit motor/brushes. 4. Replace junction unit Power PCB.
Rudder test too slow	Excessive load on steering gear. Air in hydraulic system. Insufficient drive unit capacity.	1. Look for mechanical obstructions at the rudder/tiller/quadrant. Check the back drive force. 2. Bleed the hydraulic system. 3. Replace with bigger pump unit.

Display readout	**Probable fault**	**Recommended action**
Rudder test failed	Following conditions may exist: a) Rudder feedback failure b) J3XX current overload c) Bypass/clutch overload	Refer to recommended actions for the specific probable faults.
	Rudder moves in one direction only Poor connection to one of the solenoids (continuously running pump) Faulty Power PCB in junction unit	a) Check connections b) Replace PCB
Rudder test failed (cont'd)	Rudder test not completed within 2 min. a) Poor connections to drive unit b) Faulty Main PCB in junction unit c) Faulty Power PCB in junction unit	a) Check connections b) Replace PCB c) Check PCB for traces of burnt transistors. – Change PCB.
	Rudder moves at full speed to one side. a) Faulty Power PCB in junction unit	Replace PCB

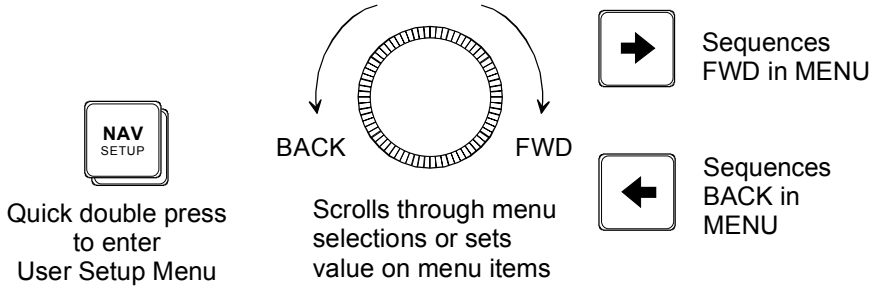
Display readout	**Probable fault**	**Recommended action**
Compass data missing	No data from selected compass.	1. If more that one compass is connected to the system, refer to the USER SETUP menu to select a different compass. 2. Check connections/Interface menu. 3. Replace compass PCB or interface PCB *(Note: Do not cut cables. The PCB contains screw terminals).*
Comm. failure active Cntrl	Active control unit goes silent.	1. Press STBY button on "Inactive" unit to reset. 2. Check/repair Robnet cable. 3. Replace control unit PCB.
J3XX current overload	Drive unit shut down due to excessive load or short circuit.	1. Check Drive unit/Drive unit installation/Manual steering/ Rudder 2. Disconnect Drive unit. If fault is still present, replace junction unit Power PCB.
Low 15 volt	Internal 15 Volt supply in Junction Unit below limit.	1. Replace junction unit Main PCB 2. Replace junction unit Power PCB if Mains voltage is 12V.
Bypass/clutch overload	Clutch/bypass current exceeds 2,5 Amps (overload or short circuit).	1. Check actual current 2. Check voltage marking on coil 3. Check coil resistance (through connecting wires)
Bypass/clutch disengaged	Poor connection or open circuit in bypass/clutch coil	1. Check connections 2. Replace bypass/clutch if open. 3. Perform new "Rudder test".
J3XX high temp.	Excessive temperature in Junction Unit (>75°C), possible long term overload.	1. Switch off autopilot 2. Check for backload in Drive unit/steering system. 3. Check that Junction unit specifications matches Drive unit.

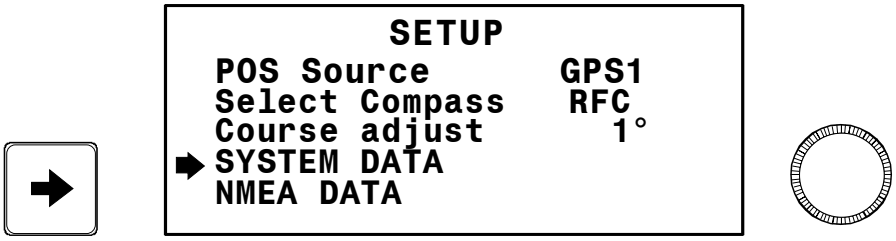
Display readout	**Probable fault**	**Recommended action**
Data failure J3XX	Wrong checksum on memory parameters or variables. Junction unit will use default values.	Perform a "Master reset" and make a new "Dockside set-up". Switch off and on again. If the alarm is repeated, replace Junction unit Main PCB.
Com. failure with J3XX	Junction Unit faulty or possible poor connections in Robnet cable from same.	1. Check Robnet connectors and cable. 2. Replace Junction unit Main PCB.
Low supply voltage	Mains voltage less than 9 Volts	1. Verify by System Data Menu 2. Switch autopilot off, charge batteries 3. Check/repair battery charger
High supply voltage	J300X, J300X-40 Mains exceeds 44 V J3000X Mains exceeds 29 V	1. Verify by System Data Menu 2. Switch autopilot off 3. Check / repair battery charger

Alarms in AUTO and NAV:		
The boat is off course	Extreme weather conditions, too slow speed. Boats heading is outside fixed off course limit of 20 deg. (Automatic reset when inside limit.)	1. Check steering parameters (Rudder, Autotrim, Seastate-filter). 2. Increase Rudder value 3. Increase boat speed, if possible, or steer by hand.
Alarms in NAV		
NAV. data failure	Missing or invalid NAV data.	1. Use NMEA Test Menu 2. Check Nav. receiver setup.

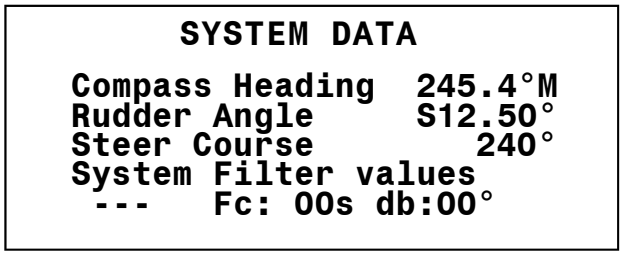
6.2 System Data Menu

The menu is accessed from the User Set up Menu (page 31). It provides you with additional system data that can be useful when testing or trouble shooting the system.





To access the system data items, turn the course knob clockwise.



Compass heading readout
M=Magnetic, G=Gyro (True)

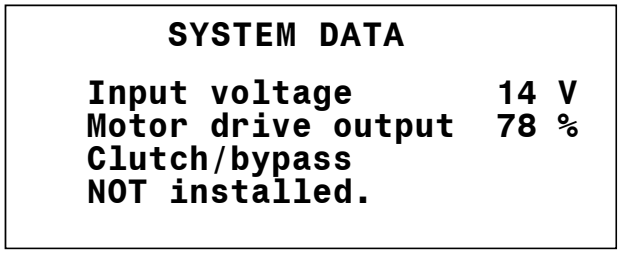
Rudder angle. Normally between zero and 45 degrees.

Steered course in Auto and Nav. mode.

Values set by the automatic seastate filter (Auto and Nav Mode).

FC=Filter time constant in seconds.

Db=Deadband in degrees to each side of set course. Boat has to be outside db before autopilot responds.



Mains voltage on input terminals

Power to drive unit in percent of full (100%)

Verifies if clutch or bypass valve has been activated when performing the rudder test.

6.3 NMEA Data Menu

The NMEA data menu is accessed from the User Set Up Menu the same way as for the System Data Menu (above). It provides you with status information of the different NMEA messages used in the system.

Decoding

The incoming signals are decoded according to a built in priority table.

Cross track and bearing information are taken from the NMEA messages with highest priority.

One of the following codes will be displayed:

--- No data or no NMEA sentence containing the data needed available at the input port.

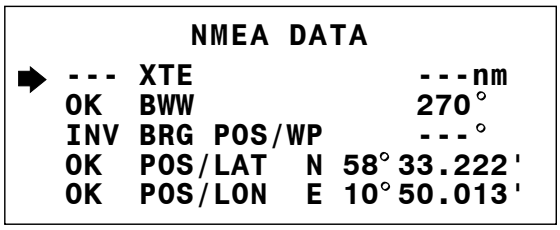
OK Valid data found

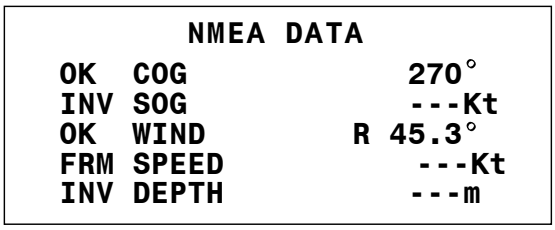
INV Message with invalid information.

FRM Message has format failure such as

a) Incorrect check sum

b) Wrong contents in datafield(s)





If data are missing or invalid, perform the following:

- Check the NMEA signal monitor (see below)
- Check the interface setup in the Installation Menu (page 94)
- Check the navigator setup and make sure it is transmitting appropriate NMEA data.
- Perform a NMEA (hardware) test as per below.

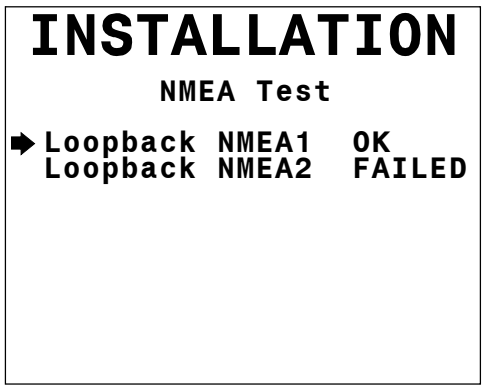
NMEA signal monitor

Close to the NMEA terminals in the junction unit you will find a green LED marked “RX”. A flickering LED indicates that a NMEA signal is received. It does not, however, qualify the contents of the message.

Note ! *Do not mix this “RX” LED with the LED marked “TX”. The “TX” LED will always be lit/flickering when the autopilot is on.*

NMEA (hardware) test

Access the NMEA Test from the INSTALLATION Menu (see page 82).



On the Main PCB in the junction unit disconnect the cables and connect TX1+ to RX1+ and TX1- to RX1-. Similar on the Power PCB connect the NMEA ports the same way; TX2+ to RX2+ and TX2– to RX2– (not available on J3000X).

Select the NMEA test menu and verify that the hardware is OK. If not, replace the corresponding PCB(s) to rectify.

Note ! *With J3XX software version V1R5 the display readout will not automatically reset to FAILED when you remove the TX/RX straps. You will have to turn the equipment off and back on again to reset.*

7 SPARE PARTS LIST

AP20 Control Unit

22084594	AP20 Control Unit
22084586	Standard mounting kit consisting of:
	22084693 Gasket (2 mm)
	22086029 Gasket (7.5 mm)
	22084529 Cabinet corner
	44162840 Cover for plug
	44165181 Screw 3,5x19
	44165645 Screw 3,5x32
22084941	Optional mounting kit consisting of:
	44148906 Screw M4x12
	22084768 Cradle
	22084776 Right bracket
	22084784 Left bracket
	22084859 Locking knob
	44163145 Locking washer for left and right bracket
	44163160 Cradle, locking washer
22084644	AP20 Front Housing Ass'y
22084925	Back cover with gasket
22084487	AP20 Board Ass'y
22084750	Protection Cover
22084834	PROM (programmed) V..R..

Junction Units

22081830	J300X Junction unit
22081822	J3000X Junction unit
22081954	J300X-40 Junction unit
22081707	J300X Installation accessories
22081855	J3000X Installation accessories
22081962	J300X-40 Installation accessories
22081251	J300X Power PCB Ass'y
22081715	J3000X Power PCB Ass'y
22081947	J300X-40 Power PCB Ass'y
22081285	J300X Main PCB Ass'y (All models)

22081640 PROM for all junction units
22081434 J300X/J3000X Base plate
22082036 J300X-40 Base plate
22081350 Main cover
22081368 Terminal cover

RFC35 Electronic Fluxgate Compass

22081459 RFC35 Fluxgate Compass
22081442 Installation accessories consisting of:
- 20104972 Mounting plate (2)
- 44140762 Screw 3.5x25 (2)
- 44140770 Screw 30x9 (4)
- 22081376 Plug (2)

22081178 RFC35 PCB Ass'y

RFC35R Rate compass

22082382 RFC35R Rate Compass
22081442 Installation accessories consisting of:
- 20104972 Mounting plate (2)
- 44140762 Screw 3.5x25 (2)
- 44140770 Screw 30x9 (4)
- 22081376 Plug (2)

22081178 RFC35 PCB Ass'y
22082374 RFC35R PCB Ass'y
22082440 Cable, 15 m with plug

RF300 Rudder Feedback Unit

20193462 RF300 Rudder Feedback
20193470 RF300 transmission lever
20193454 RF300 transmission link
- 44133122 Transmission rod M5x325mm
- 20193624 RF300 Ball joint Ass'y (2)

CI300X Compass Interface

22081137	CI300X Compass Interface
22082044	CI300X PCB Ass'y
20193256	Box
20193264	Cover
44138816	Cover nutknobs
20191607	Robnet Cable 7m

NI300X NMEA Interface

22081129	NI300X NMEA Interface
20191607	Robnet cable 7m
22081913	NI300X PCB Ass'y
20193256	Box
20193264	Cover
44138816	Cover nutknobs

Robnet cables and connectors

22081145	Robnet cable 15 m (49") with one male connector
20191607	Robnet cable 7m (23') with male connectors
20191615	Robnet cable 15m (49') with male connectors
20192266	Robnet extension cable 10m (33') with male and female connector
44138048	Robnet cable (bulk)
22082697	Male connector - crimp type
22082705	Female connector - crimp type (for extension cable only)

Tools

44139707	Key for Lock ring on Robnet receptacles
44139806	Extraction tool for PROM
44161792	Robnet pin extraction tool (for crimp type connectors)

8 GLOSSARY

NMEA 0183 - A format (language) designed to permit communication between various types of marine electronic equipment. In essence this is a two-wire shielded, serial data link, permitting one device to talk while other devices listen. Numerous different sentences are available, permitting communication between various different devices.

GPS - Global Positioning System - This system consists of 18 satellites plus 3 spares in fixed orbits, circling the earth at an altitude of approximately 20,200 km. The system will provide the user with 24 hour a day all weather position coverage, with an accuracy of 15 to 100 meters.

Loran C - A complex radio navigation network developed by the US coast guard, to assist a navigator in determining his precise location. The acronym, Loran C, stands for Long Range Navigation. It is an all weather 24 hour a day electronic system of shore based radio transmitters.

Waypoint - A discrete point, stored in a navigator, located on the surface of the earth. Normally this point will be identified by Lat/Lon coordinates although in some systems it may be shown by T.D.'s. The AP300DLX has the capability of storing 98 waypoints.

Route - A stored sequence of waypoints. These waypoints will be listed in the order in which you desire to follow them. The AP300DLX permits the storage of up to 20 routes.

XTE - Cross Track Error - Used to identify a vessels position relative to a straight line drawn between two waypoints. The amount the vessel is off to the left or to the right of this line is known as the track. It is normally displayed in hundredths of a nautical mile, equal to 60 ft or 18,5 m.

BWW – Bearing waypoint to waypoint - Bearing angle of the line between the “TO” and the “FROM” waypoint, calculated at the “FROM” waypoint for any two arbitrary waypoints.

BRG POS - WP – Bearing to a specified waypoint from present position.

SOG - Speed over ground is the actual speed of the vessel relative to the ocean floor.

COG - Course Over Ground - The actual direction of progress of a vessel, between two points, with respect to the surface of the earth, The vessels heading may differ from the course over ground due to the effects of wind, tide, currents.

Magnetic variation - A magnetic compass points to the magnetic north pole. The difference between this direction and true north is the magnetic variation. The amount and direction of this variation is dependent upon where on the earth you are located.

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TERMS OF WARRANTY, SIMRAD AS PRODUCTS

SIMRAD warrants that every product shall be free of defects in material and workmanship as specified below:

CATEGORY "A":

• Autopilots • Radars • Instruments • Navigators • Radiotelephones • Plotters
• Gyro compasses incl. sensitive elements • Sonars • Echosounders
• Trawl Instrumentation.

These products are warranted for a period of 24 months on parts and 12 months on labour from date of purchase, except for category B items. Consumable parts such as lamps, fuses, batteries, bearings etc. are not covered by this warranty.

CATEGORY "B":

• Antennas • Transducers • Trawl sensors • Monitors (CRT/LCD) • Radar magnetrons
• Disk drives.

These items are warranted for a period of 12 months on parts and labour from date of purchase.

WARRANTY SERVICE is available through authorised service dealers or national distributors worldwide. Products returned will, at the sole discretion of Simrad, either be repaired or replaced free of charge within normal working hours. Freight charges, insurance, duties or any other costs are the responsibility of the customer.

Maximum liability shall not, in any case, exceed the contract price of the products claimed to be defective.

ON BOARD SERVICE can be arranged by authorised local service dealers or national distributors upon request. Labour costs for the repair/replacement of the defective modules/parts will be free of charge provided a valid warranty is confirmed. Overtime, travel, lodging, per diem, insurance, duties or any other costs are the responsibility of the customer. Additional expenses connected with replacement of transducers such as dry docking, diving and precautionary measures are not covered by this warranty.

VALIDITY: This warranty is effective only when warranty certificate or proof of purchase and equipment serial number is presented. Furthermore, the installation and operation has to be carried out in accordance with the product manual. Warranty liability does not apply to any equipment which has become inoperative due to misuse, accident, neglect, sea water damage or unauthorised repair. Simrad will not be liable for any loss, incidental or consequential damages whether based upon warranty, contract or negligence, or arising in connection with the sale, installation, use or repair of the product. Consequential damages include, but are not limited to, any loss of profit, property damage or personal injury.

The terms of warranty as described does not affect your statutory rights.